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A REPORT OF CASES OF PERNICIOUS ANÆMIA, WITH SPECIAL REFERENCE TO THE BLOOD-FINDINGS.[1]

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In the twenty cases herewith reported the diagnosis of pernicious anæmia was based upon the clinical history and the physical findings, but most of all upon the blood condition. The individual histories, briefly given, show in most of the cases the absence of morbid physical findings except those due to anæmia. The important anatomical changes recognized clinically are noted in the general conclusions.

The high color index, the severe degree of poikilocytosis, the constant presence of polychromatophilia, and the presence of megaloblasts, usually predominating, at some period of the observation, over the normoblasts, were considered pathognomonic of the disease.

In five of the cases but one personal examination of the blood was made. The history of these cases and the blood condition were so characteristic that it seems proper to report them as pernicious anæmia. In all the remaining cases a sufficient number of observations were made and the cases were studied over a sufficiently long period of time to make the diagnosis certain. Six of the cases were observed and studied over a period of from five months to one year. In most of these cases blood examinations were made every month.

The clinical course was found to be that usually observed. Periods of improvement occurred, followed by periods of decline. During these periods the blood condition was materially altered. Charts of the blood condition showing the color index, the number of red and white cells, the percentage of hæmoglobin and the number of nucleated red cells per c.m. of Cases X., XI., XIII., XIV., and XV., during periods of improvement and decline, show more graphically than words the varying condition of the blood.

[1] Read at the meeting of the Association of American Physicians, Washington, D. C., May, 1900.

Case No.	Date.	Hæmoglobin.	Specific gravity.	Reds.	Color index.	Whites.	Small mono-nuclear.	Large mono-nuclear.	Polymorpho-nuclear neutrophile.	Eosinophile.	Myelocytes.	Nucleated reds in 1 c.mm.				Poikilocytosis.	Polychroma-tism.	Remarks.
												Normo-blasts.	Micro-blasts.	Megalo-blasts.	Total.	Irregu-larity of nucleus.		
I.	1899 Mar. 18	24	.....	1,400,000	0.94	21,000	6.2	2.8	90.7	0.3	0.0	84	0	84	168	+	+	Died Mar. 20, 1899.
II.	Aug. 31	34	.....	1,010,000	0.85	6,000	38.0	1.4	60.0	0.4	0.2	39	0	189	228	+	+	Died Sept., 1899.
III.	Aug. 27	57	1039	488,000	1.16	6,000	32.4	8.4	52.0	0.4	6.8	144	360	1224	1704	+	+	
	Sept. 7	34	1036	530,000	3.52	9,000	38.4	5.6	44.8	0.8	10.4	1458	1332	2700	5420	+	+	Died Sept. 22, 1899.
IV.	Sept. 17	26	1031	560,000	2.55	34,000	25.9	10.1	34.2	0.4	29.4	1768	1496	7092	10336	+	+	
V.	Sept. 5	34	1039	1,436,000	1.30	4,500	28.8	0.8	68.0	1.6	0.8	18	0	54	72	+	+	
	July 29	48		845,000	1.62	3,500	27.0	2.0	68.0	3.0	0.0	7	7	7	21	+	+	Great improvem't.
VI.	Aug. 14	25	1046	1,624,000	1.63	6,000	21.0	3.0	71.6	4.0	0.4	12	0	0	12	+	+	
	May 10	21	.....	828,000	1.39	6,000	.....	.....	.....	.....	.....	...	...	...	...	...	...	Improvement.
	Sept. 27	40	.....	2,080,000	1.26	7,600	.....	.....	.....	.....	.....	...	...	...	...	...	...	
	Oct. 20	55	1032	1,912,000	1.15	2,000	27.0	2.0	71.0	1.0	0.0	2	0	2	4	+	+	
VII.	Nov. 3	18	1032	679,000	1.45	2,000	28.0	1.0	69.0	1.0	1.0	45	0	270	315	+	+	Died Nov., 1899.
	Dec. 13	20	1033	540,000	2.08	3,500	33.2	2.4	62.4	0.8	1.2	30	14	84	128	+	+	
VIII.	Dec. 17	17	1028	760,000	1.23	9,000	27.0	0.6	71.2	1.2	0.0	54	0	81	135	+	+	Died Jan., 1900.
	Dec. 29	20	1028	880,000	1.25	2,000	13.6	2.9	83.2	0.8	0.4	6	0	9	15	+	+	
IX.	Sept. 27	21	1029	864,000	1.22	6,000	38.0	1.4	60.0	0.4	0.2	6	0	0	6	+	+	Died Nov., 1899.
X.	May 9	33		2,000,000	0.91	.....	48.0	3.0	48.0	1.0	.....	8	0	8	16	+	+	
	July 25	28	1029	900,000	1.7	4,000	52.0	1.2	46.8	0.0	0	44	0	4	48	+	+	
	Aug. 9	21	1029	1,110,000	1.04	4,000	52.0	1.2	46.8	0.8	0	24	0	16	40	+	+	
	Aug. 6	27	1031	1,008,000	1.47	5,000	60.8	1.2	37.2	0.8	0	20	0	80	100	+	+	
	Sept. 30	30	1033	1,300,000	1.27	1,500	49.2	2.4	48.0	0.0	0	0	0	0	0	+	+	Improvement.
	Oct. 14	28	1032	1,118,000	1.38	3,000	43.5	0.5	55.0	0.5	0.5	0	0	0	0	+	+	
	Nov. 5	38	1038	1,620,000	1.29	2,000	46.5	1.0	52.0	0.0	0.5	10	0	0	10	+	+	"
	Dec. 5	42	1042	2,240,000	1.03	2,000	42.0	2.0	55.0	1.0	0	0	0	0	0	+	+	"
	1900																	
	Jan. 7	49	1047	4,000,000	1.16	4,000	45.0	2.0	51.0	2.0	0	1	0	3	4	+	+	"
	Feb. 5	62	1051	2,550,000	1.33	6,000	40.0	1.0	58.0	1.0	0	0	0	0	0	+	+	"
	Mar. 3	65	1053	3,200,000	1.12	6,000	34.4	4.8	60.8	0.8	0	0	0	0	0	+	+	"
	April 6	74	1058	4,010,000	1.01	6,500	36.5	6.0	56.5	1.0	0	0	0	0	0	+	+	"
	May 5	75	1060	4,146,000	0.99	7,000	40.0	2.0	57.0	1.0	0	0	0	0	0	+	+	"
	June 2	80	1060	4,210,000	1.04	6,200	37.0	6.0	56.0	1.0	0	0	0	0	0	+	0	"
	1898																	
XI.	Dec. 29	45	.....	2,228,000	1.11	3,500	23.0	5.0	69.0	2.0	1	70	0	0	70	...	+	Improvement.
	1899																	
	Feb. 14	58	.....	2,988,000	1.07	4,600	22.0	6.0	67.0	5.0	0	55	0	0	55	...	++	"
	April 28	65	.....	3,276,000	1.09	7,200	23.0	8.0	66.0	3.0	0	0	0	0	0	...	0	Decline.
	July 31	23	1033	886,000	1.43	3,500	30.4	4.0	63.1	2.0	0.5	70	14	308	392	++	++	

	1899																	
	Aug. 2	23	1033	1,044.000	1.21	4,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	...	...	
	Aug. 5	25	1033	944,000	1.3	4,500	28.0	3.0	66.0	2.5	0.5	60	20	340	420	++	++	++	
	Aug. 11	19	1030	720,000	1.42	4,750	17.2	0.4	78.8	3.0	0.6	85	19	300	385	++	++	++	Died Aug 15, 1899.
XII.	Oct. 24	32	1035	2,100,000	0.84	8,000	29.0	0.5	68.0	2.0	0.5	16	0	24	40	+	++	+	
	Nov. 10	37	1037	2,020,000	1.00	3,000	17.5	5.5	72.0	5.0	0.0	5	0	10	15	+	++	+	
	Dec. 6	48	1047	2,348,000	1.12	9,000	24.5	2.0	67.5	5.5	0.5	4	0	4	8	+	+	+	Improvement.
XIII.	Sept. 8	25	1034	960,000	1.4	3,000	54.8	1.6	43.6	0.0	0	12	12	12	36	+	++	++	
	Sept. 28	35	1038	1,968,000	0.98	2,000	49.8	0.8	47.8	1.6	0	16	24	32	72	+	++	+	Improvement.
	Oct. 20	42	1045	3,060,000	0.77	2,000	39.5	1.5	55.5	3.5	0	2	0	0	2	0	+	+	"
	Nov. 26	44	1045	2,736,000	0.88	1,500	30.0	6.0	57.0	7.0	0	0	0	3	3	sl	+	+	"
	Dec. 29	50	1046	2,760,000	1.0	2,000	44.0	8.0	45.0	3.0	0	0	0	0	0	0	+	+	"
	1900																		
	Feb. 11	64	1052	3,250,000	1.1	4,000	35.0	5.0	55.5	4.0	0.5	0	0	0	0	0	+	+	"
	Mar. 21	72	1054	3,720,000	1.07	6,000	30.0	6.0	56.0	7.0	1.0	0	0	0	0	0	+	+	"
	May 2	75	.....	4,140,000	0.99	6,500	32.0	4.0	59.0	5.0	0	2	0	0	0	0	sl	sl	"
XIV.	1899																		
	Nov. 3	22	1031	744,000	1.62	1,000	57.0	4.5	38.5	0.0	0	25	5	85	115	+	++	+	
	Nov. 10	22	1031	810,000	1.49	1,500	60.0	2.0	33.0	4.5	0.5	15	0	81	96	+	++	+	
	Nov. 17	20	1033	920,000	1.20	2,000	41.5	5.0	46.5	7.0	0	10	20	60	90	+	++	+	
	Dec. 7	44	1046	2,536,000	0.95	3,000	42.0	3.0	44.0	10.0	1.0	0	0	0	0	0	+	+	Improvement.
	1900																		
	Jan. 1	55	1048	2,800,000	1.08	8,500	16.0	2.6	76.0	5.0	0.4	19	0	51	70	+	++	sl	"
	Jan. 18	62	1052	2,650,000	1.28	6,000	20.0	7.0	65.0	8.0	0	12	0	12	24	0	+	sl	"
	Feb. 23	54	1050	2,400,000	1.23	4,000	32.0	4.0	60.5	3.5	0	4	4	32	40	0	+	sl	"
	Apr. 10	20	.....	1,132,000	0.97	3,500	46.8	0.8	49.0	0.8	2.0	14	0	102	116	sl	++	++	Decline.
	May 8	20	1032	630,000	1.74	1,200	51.0	1.0	46.0	1.0	1.0	12	0	36	48	+	+++	+++	"
XV.	1899																		
	May 20	32	1037	726,000	2.4	5,000	21.8	5.0	73.0	1.0	0.2	10	0	20	30	+	++	+	
	Sept. 16	60	1051	3,500,000	0.94	7,000	20.0	0.8	76.4	2.8	0	0	0	0	0	0	sl	sl	Improvement.
	Oct. 11	52	1048	2,088,000	1.32	5,000	29.0	0.5	70.0	1.5	0	0	0	0	0	0	+	+	Decline.
	Dec. 9	26	1034	1,160,000	1.23	1,500	25.2	2.0	60.0	2.0	0.8	6	0	36	42	+	++	++	"
	Dec. 18	22	1033	880,000	1.40	2,000	25.0	1.0	70.0	1.0	1.0	4	0	28	32	+	++	++	"
	1900																		
	Jan. 2	38	1039	1,868,000	1.10	3,000	30.5	2.0	65.0	2.0	1.0	30	0	45	75	+	++	++	Improvement
	Feb. 6	50	1051	2,560,000	1.07	4,500	39.0	1.0	56.0	1.0	0	90	0	180	270	+	++	+	"
	Mar. 11	50	1048	2,240,000	1.10	3,000	20.8	2.8	74.0	2.8	0.4	12	0	36	48	+	++	+	Decline.
	Apr. 17	30	1036	1,568,000	1.6	3,500	40.0	2.0	56.0	0.0	2.0	0	0	70	70	+	++	++	Died May 21, 1900.
XVI.	Jan. 19	15	.....	912,000	0.91	7,200	8.0	12.6	79.0	0.1	0.3	7	0	14	21	+	++	+	
	June 16	19	.....	1,762,000	0.6	7,000	7.4	4.4	87.7	0.5	0	7	0	14	21	+	++	+	
XVII.	Mar. 28	20	.....	701,200	1.57	4,140	44.8	3.8	50.0	1.0	0.4	8	0	24	32	+	+++	++	Died April 6, 1900.
XVIII.	Apr. 4	20	.....	1,674,000?	0.66	1,140	25.5	3.0	69.0	1.0	1.5	1	0	4	5	+	++	++	
XIX.	Apr. 13	25	.....	156,000	8.9	5,936	39.8	1.6	57.0	1.4	1.2	2	0	24	26	+	++	++	Died June 16, 1900.
	June 9	30	.....	996,000	1.7	3,330	42.0	3.5	53.0	1.5	1.0	0	0	10	10	+	++	++	
XX.	June 1	30	.....	756.000	2.0	3.000	.....	.....	.....	.....	.....	...	...	...	...	...	...	...	
	June 15	26	1035	980,000	1.46	8,000	18.0	0.8	78.4	2.0	0.8	32	128	400	660	++	++	++	

Chart VI. (p. 519) shows a differentiation of the white cells in Case XV. It will be noted that in most of the cases the white count is decreased and the number present corresponds somewhat with the rise and fall of the red cells and percentage of hæmoglobin. It will also be noted that the decrease in leucocytes is due to an absolute decrease in the polymorphonuclear forms.

The accompanying table of the blood counts, including the differentiation of the white cells, the enumeration of the nucleated red cells, the presence or absence of degeneration of the nucleus of the megaloblast (classed as irregularity of the nucleus), the presence or absence of poikilocytosis and polychromatophilia (+ = marked ++ = very marked, +++ = extremely marked) is self-explanatory. In the table and charts the percentage of hæmoglobin is based upon the estimation made with the Fleischl instrument, and the actual reading is given uncorrected. The Thoma-Zeiss instrument was used for all blood counts.

Of the twenty cases ten have died. Upon two only was it possible to obtain an autopsy. In both the post-mortem findings were typical of the disease. As nothing unusual was found, I shall not take space to describe the morbid anatomy.

In the other eight cases autopsy was not made because of objections made by relatives or because the patient was at some distance in the country and inaccessible to the writer at time of death.

Case I.—Male, aged sixty-two years, admitted to the Cook County Hospital, March 18, 1899. Laborer, suffering from great weakness, prostration, and profound anæmia. Physical examination revealed general arterio-sclerosis, emphysema pulmonum, with dilatation of both sides of the heart.

Blood examination showed 1,400,000 reds, 24 per cent. hæmoglobin, and 21,000 white cells. There were present marked poikilocytosis, polychromatophilia, and a total of 168 nucleated red cells per cubic millimetre, of which 84 were megaloblasts. The patient died on March 20. No autopsy was obtainable.

The physical findings in this patient were senile in character, and there was nothing to account for the condition of the blood in the physical findings.

In this case the color index was below normal. The leucocytosis was probably of the terminal form, as the patient died two days later. This accounts for the excess of the polymorphonuclear neutrophiles which were present. The megaloblasts were typical and showed much irregularity of the nucleus.

Case II.—Female, aged thirty-four years, married, American, and has borne one child. Was seen first in May, 1898. She gave a history of illness of about one year's duration. She was pale, complained of want of strength and endurance. Blood examination revealed 2,800,000 red cells and 40 per cent. of hæmoglobin. There were no nucleated red cells found, and the white count showed 8000 per cubic millimetre. The spleen was palpable. There was a slight eczema-like eruption in

both axillæ and about the pubic region. The urine was of light weight, but contained no abnormal ingredients.

The physical findings were negative excepting those named. The patient improved upon restorative treatment of arsenic and iron. In the fall of 1898 she complained of weakness of the lower extremities associated with paræsthesia. There was tenderness upon pressure over the anterior crural nerve and over the musculo-cutaneous branch of the external popliteal. The knee-jerk was diminished. The patient had good control of the bladder and the bowels. The anæmia was still present and practically of the same grade as at the first examination. The patient was not seen again until August, 1899, when she presented evidences of paraplegia associated with paræsthesia of the skin of the lower extremities, diminution of tactile, temperature, and pain sense, a partial loss of control of the bladder, marked ataxia, and inco-ordination. The knee-jerk was entirely lost. The Argyll-Robertson pupil was not present. The fundi were normal. The pulse was rapid, 90 to 100 per minute, and the temperature subfebrile, usually normal in the morning, but from 99° to 100° in the evening. From the middle of August the patient grew worse, with rapidly diminished power in the lower extremities until complete paralysis resulted, with loss of control of both the bladder and the bowels Tympanites was constant; the anæmia increased, and on August 31 a blood count showed 34 per cent. of hæmoglobin, 1,010,000 red cells, 6000 whites, with 228 nucleated cells per cubic millimetre, of which 189 were megaloblasts. Poikilocytosis was marked, and polychromatophilia present. The paralysis extended upward, involving successively the segments of the cord, with corresponding nerves, and the patient finally died on September 7, 1899, from involvement of the respiratory and cardiac centres.

This patient at the beginning showed anæmia which did not present the characteristics of a pernicious anæmia, either in the color index or in the presence of nucleated or irregular-sized and formed cells. Later the spinal cord symptoms predominated, and, although the anæmia was observed and was considered important, it was not looked upon as a pernicious type until the final examination, eight days before death. The character of the blood at this time was so characteristic of pernicious anæmia that one is forced to look upon the case as primarily a pernicious anæmia with the spinal cord lesion as one of the not unusual accompaniments of the disease. An autopsy was unobtainable.

The blood findings in this case were typical of pernicious anæmia. The megaloblasts were nearly all polychromatophilic, in addition to having an irregularly-shaped and sometimes palely staining nucleus.

Case III.—Male, aged twenty-four years, seen first on August 27, 1899, with Dr. H. B. Favill. The patient first felt unwell in June of 1899. He was losing strength, and his endurance lessened. He had charge of the finances of a rather large estate and had much responsibility. Without medical advice, he took a rest in the country during the latter part of June and the first half of July. He did not improve, and returned to Chicago. He noticed that he was very pale, breathless upon exertion, and that he was daily growing weaker. He had no pain, and no disturbance of any kind excepting a sense of weakness and languor.

The physical findings were negative, excepting a rather rapid pulse, which was weak, and the temperature ranged from normal in the morning to 100° or 101° in the evening.

A blood examination made on August 27 showed hæmoglobin 37 per cent., with 488,000 reds per cubic millimetre, with a very high color index of 4.16; 6000 white cells, and 1704 nucleated cells per cubic millimetre, of which 1224 were megaloblasts. There was marked poikilocytosis, and polychromatophilia was also present.

On September 17 a final blood count was made which gave 26 per cent. of hæmoglobin, 560,000 red cells per cubic millimetre, with the enormous number of 10,336 nucleated red cells per cubic millimetre, of which 7092 were megaloblasts. There was marked irregularity of the nucleus, especially in the megaloblasts, with increased poikilocytosis and notable polychromatophilia.

During the last week of the patient's life his temperature rose to 104° in the afternoon of each day, with the pulse rapid and weak, and with symptoms of profound weakness, much dyspnœa, and dizziness. There was looseness of the bowels during the entire course, and in the stools were found many infusoria, but no organism which could account for the anæmia. The patient died on September 22. An autopsy was not obtained.

This case was remarkable as showing a very low red count, with an unusually high color index, which is explained by the very large number of macrocytes present. It is noteworthy that during the period in which he was observed the red corpuscles were practically stationary in number, while the hæmoglobin continued to fall. The leucocytes steadily increased with approaching death, and a few days before death there was an inundation of leucocytes, myelocytes, and nucleated red corpuscles, the degenerative megaloblasts predominating. The stained specimen gives findings similar to those of splenic myelogenous leukæmia, but the paucity of red corpuscles and hæmoglobin, the high color index, and the comparatively low white count, as well as the extreme poikilocytosis and polychromatophilia conclusively settled the diagnosis. The number of nucleated red corpuscles was enormous, with many of the nuclei fragmented.

Case IV.—Female, aged forty three years. Seen with Dr. McInnes, of Belvidere, Illinois, September 5, 1899. Has borne three children. The patient has had chronic diarrhœa for three years with loose, watery movements on rising, and occasionly one or more later in the day, uninfluenced by diet. For several months she has had progressive weakness and fatigue, associated with pallor. The skin has become yellow recently. There was slight swelling of the feet at night; nose-bleed slight on two or three occasions. There was palpitation of the heart. Patient had a desire for sour things; some eructation of gas, but has not vomited; was nervous. There was no blurring of vision. Weighed two years ago 135 pounds, now 107 pounds. Examination showed a systolic murmur at the apex transmitted into the axilla. No accentuation of the second pulmonic sound. A murmur, systolic in time, was heard in the aortic area. No venous hum in the neck. The spleen was palpable.

The patient was pale, and the skin had a yellowish hue. The urine showed a slight trace of albumin, with a little pus. No tubercle bacilli in the urinary sediment. Feces, greenish and watery in color, showed

no parasites. The blood showed hæmoglobin, 36 per cent.; red cells, 1,436,000; white cells, 4000, with poikilocytosis, and 72 nucleated cells per cubic millimetre, of which 54 were megaloblasts. There was irregularity of the nucleus of some cells, with poikilocytosis and polychromatophilia.

The patient improved upon restorative tonics of iron and arsenic, and the diarrhœa ceased with colonic flushings; during the winter of 1899 and 1900 the patient improved and was considered well for two or three months. Her physician reported in March, 1900, that she had again become very anæmic, with all the characteristics observed when first examined, and that she was then confined to bed. No further examination of the blood has been made.

Case V.—Female, aged fifty-six years, admitted to the Cook County Hospital, July, 1899. Seamstress, who gave a history of illness of about one year's duration. She was very pale; skin yellowish, and presented no physical findings of organic disease. There was a basic murmur, systolic in time, transmitted into the neck, but no venous hum. The urine was negative. The bowels were constipated. The patient complained of extreme weakness, shortness of breath on exertion, and dizziness when she changed her position suddenly.

Examination of the blood showed hæmoglobin, 25 per cent.; 848,000 red cells; 3500 whites; 21 nucleated red cells, of which 7 were megaloblasts. Poikilocytosis was very marked, and polychromatophilia present.

On restorative tonics the patient improved rapidly, so that on August 14th the hæmoglobin was 48 per cent., the red cells 1,624,000, still giving a high color index. There were 6000 whites and 12 nucleated red cells, all of which were normoblasts. The patient was so improved in strength that she left the hospital, and no further observation has been made.

In this case there was a rapid increase of the reds and of the hæmoglobin—100 per cent. in sixteen days. The color index was high and did not fall with the improvement, which is contrary to the usual rule in this disease. The leucocytes rose with improvement. The nucleated reds were few in number. The megaloblasts disappeared with improvement, and poikilocytosis and polychromatophilia decreased.

Case VI.—Male, aged sixty-one years, married, banker. Seen first on May 10, 1899. His family history was excellent. In the summer of 1898 he first noticed that he was easily exhausted on exertion. There was some coldness of the lower extremities, with numbness. He had dyspnœa on exertion, and some dizziness. The appetite failed in March, 1899, and since then has been very poor. There was a bitter taste which was present in many kinds of food. Has had some gas and weight in the stomach after eating. Bowels were usually regular; urination was normal. There was no pain. His weight was 155 pounds; he weighed 190 when well. He was very pale; there was a lemon-yellow color of the skin. There was a blowing systolic murmur over the præcordium, loudest in the mitral area. There was a venous hum in the neck. There were no other abnormal physical signs. There was a slight trace of albumin in the urine. The blood showed 828,000 red cells, with 25 per cent. of hæmoglobin, and 6000 whites. There were many nucleated red cells, and marked poikilocytosis.

There was improvement under restorative tonic treatment; the patient presenting 50 per cent. of hæmoglobin, and 2,080,000 red cells in September, after which there was a relapse. On October 30th the hæmoglobin was 40 per cent., and the red cells 1,912,000. There were four nucleated red cells per cubic millimetre, of which two were megaloblasts.

This patient has presented from the beginning all of the usual phenomena of a pernicious anæmia. When last heard from he was in California, and becoming gradually worse.

It is to be noted that there is a fall of the color index with improvement, with an inconstant leucocyte count, and but few nucleated red cells.

CASE VII.—Female, aged forty seven years, was admitted to Cook County Hospital, October 14, 1899. She had been transferred from the Detention Hospital for the Insane. She was of unsound mind; could not answer questions intelligently. Her friends gave a history of illness of about three months. Examination showed intense yellow pallor without emaciation. There were many small hemorrhagic spots in the skin of the body and the mucous membrane of the mouth. The retinæ were normal. There was a systolic apex murmur with dulness on percussion extending beyond the left nipple. Spleen not palpable. The bowels were constipated. Examination of the feces was negative. The temperature varied from 98° in the morning to 100.2° in the evening. The urine was negative. The blood gave 18 per cent. of hæmoglobin, 679,000 reds, 2000 white cells, marked poikilocytosis, with 315 nucleated red cells per cubic millimetre, of which 270 were megaloblasts.

On November 3d there was 20 per cent. hæmoglobin, 540,000 red cells, and 128 nucleated reds, of which 84 were megaloblasts. There was extreme irregularity of the nucleus, much poikilocytosis, and marked polychromatophilia. The patient died November 10th. An autopsy was not obtained.

Just before death the color index rose with the decline of the patient. The leucocytes increased slightly, the nucleated reds diminished in number, while the poikilocytosis was extreme and corresponded with the low red count.

CASE VIII.—Male, aged fifty-two years, shoedealer. Admitted to the Presbyterian Hospital in November, 1899. Ill for about a year. For seven months has been subject to fainting attacks, with much weakness, some shortness of breath and dizziness. There has been marked pallor for several months. Bowels alternately loose and constipated. There has been some nose-bleed. The patient has not lost in weight. The skin was lemon-yellow; pulse small, compressible and weak. A blowing murmur was heard over the mitral area and at the base of the heart, transmitted into the neck. Spleen and liver negative; urine negative. Blood examination on December 11th showed 17 per cent. hæmoglobin, 760,000 red cells, 9000 whites, 135 nucleated reds per cubic millimetre, of which 81 were megaloblasts. On December 29th there was 20 per cent. of hæmoglobin, 880,000 reds, 2000 whites, and 15 nucleated reds, of which 9 were megaloblasts. There was much poikilocytosis and polychromatophilia. The patient died in January, 1900. Post-mortem revealed the usual findings of a pernicious anæmia, including fœtal bone marrow.

It is to be noted that in this case a few days before death the condition of the hæmoglobin and red corpuscles was stationary. The leucocytes fell with the decline, as did also the nucleated red cells. The poikilocytosis and polychromatophilia corresponded in degree with the number of red cells,

CASE IX.—Female, aged thirty-six years, housekeeper. Seen with Drs. Favill and Storer, September 27, 1899. Has suffered from goitre and symptoms of general nervousness for several years. For a year past has suffered from gradual increasing weakness until prostration occurred, and has been confined to bed for the last three months. There has been a rapid heart, with tremor of the muscles, indigestion with poor appetite and gradual emaciation. There has been headache, with many subjective nervous symptoms, including paræsthesia of the skin, numbness and coldness of the lower extremities, sleeplessness, and at times nausea and vomiting after some emotional disturbance.

Examination shows marked pallor of a yellow hue, emaciation, tremor of the extremities, especially upon exertion, a goitre of moderate size, vascular and throbbing, increase of the heart dulness beyond the left nipple, a murmur in the mitral area, systolic in character, a venous hum over the neck, and especially over the goitre, a pulse of 140 per minute, weak, quick, and compressible. Temperature subnormal in the morning and elevated to 99° or 100° in the evening. Negative findings over the abdomen; the urine free of abnormal elements. The pelvis normal. The blood on September 27, 1899, showed 20 per cent. of hæmoglobin, 864,000 red cells, 6,000 whites, with 6 nucleated red cells per cubic millimetre, all megaloblasts. Some of the nucleated cells showed irregularity of the nucleus. There was poikilocytosis and polychromatophilia.

The clinical course and physical finding made a diagnosis of exophthalmic goitre probable, although there was no exophthalmos present upon examination, nor any history of that sign. The patient died in November, 1899, showing no change in the condition enumerated above. No autopsy.

Neusser (*American Year Book of Medicine*, 1900, page 127, quoted from the *Wiener klinische Wochenschrift*, April 13, 1899) describes a case of exophthalmic goitre occurring with pernicious anæmia. In the case reported here it is to be noted there was a small number of nucleated red cells, but they were all megaloblasts.

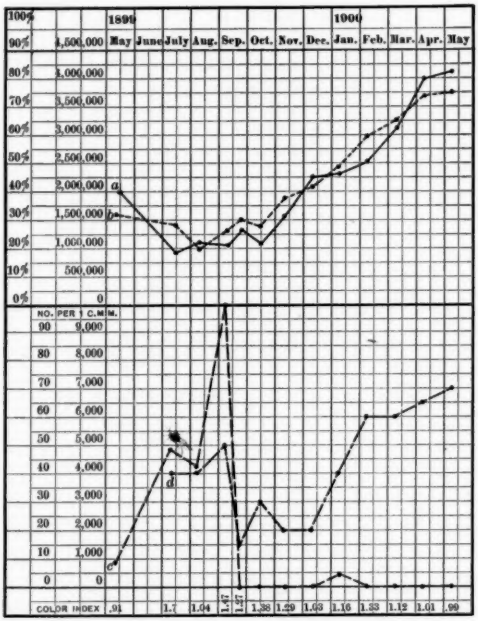
CASE X. (See Chart I.)—Male, aged thirty-six years, a collector, married. Patient had a severe attack of influenza in January, 1899. He was confined to bed for ten days; otherwise his health had been good since childhood. Following illness in January he had remained unwell, had grown pale, and had noticed a progressively increasing weakness, with slight dizziness and dyspnœa upon exertion. The extremities were often cold, and there was palpitation of the heart at times. The appetite was good, and digestion unimpaired. The bowels were slightly constipated. The patient had no other discomfort than those enumerated.

Examination showed no emaciation, lemon-yellow pallor, a few petechial spots about the chest and base of the neck in front, and a few in the

roof of the mouth. There was a murmur over the base of the heart transmitted into the neck, and a venous hum was also heard over the large vessels of the neck. The urine was normal, and the physical findings over the abdomen negative. The blood showed no plasmodia, with 33 per cent. of hæmoglobin, 2,000,000 red cells, 16 nucleated cells, of which 8 were megaloblasts; poikilocytosis and polychromatophilia present.

Upon restorative tonics the patient did not improve. There was a gradual decline in health, evidenced by the blood-findings which, on

CHART I.



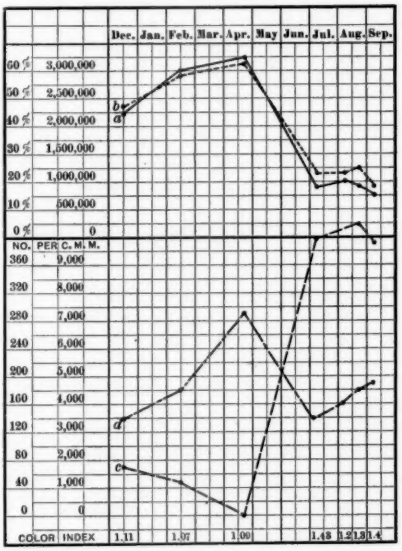
CASE X. *a*. Red corpuscles. *b*. Hæmoglobin. *c*. Nucleated red corpuscles. *d*. Leucocytes.

September 6th, showed hæmoglobin of 27 per cent., 1,800,000 reds, 5,000 whites, 100 nucleated red cells, of which 80 were megaloblasts, with the ordinary associated irregularity in size and shape of cells and polychromatophilia. Improvement occurred from this time onward, until at the last examination, when there was 74 per cent. of hæmoglobin, 4,010,000 red cells, 6500 white cells, and no nucleated cells. This patient is still under observation and presents phenomena which unmistakably confirm the first diagnosis, and show that he is still ill, although the blood condition is so much improved.

In this case the color index was nearly always high, the tendency being to decrease slightly with the improvement. The leucocytes increased usually with the general improvement of the patient. There was a flood of nucleated red cells, the so-called crisis before improvement, and these disappeared with the improvement. Megaloblasts predominated. Poikilocytosis and polychromatophilia were markedly less than is usual in patients with a corresponding red count. The improvement wave in this case has continued steadily for about six months.

CASE XI. (See Chart II.)—Male, aged forty-five years, lawyer. Gives a history of illness extending over one year. Seen in consulta-

CHART II.



CASE XI. *a*. Red corpuscles. *b*. Hæmoglobin. *c*. Nucleated red corpuscles. *d*. Leucocytes.

tion with his physician, Dr. A. J. Coey. Patient has always been a hard worker, taking but little rest, and having large responsibilities. He has suffered from no illness during his life until at present. An examination on December 29, 1898, showed no loss of weight, but a lemon-yellow pallor, with a small, quick, compressible pulse, and normal temperature; a weak heart-beat, with a faint systolic murmur at the base; no venous hum in the neck. Negative findings over the chest excepting as stated, and over the abdomen. Urine normal. Patient complained of weakness, with shortness of breath on exertion, dizziness, palpitation of the heart, poor appetite and some gaseous indigestion.

Blood count showed 40 per cent. of hæmoglobin, 2,228,000 red cells, 3500 whites, 70 nucleated reds, all of them normoblasts; poikilocytosis and polychromatophilia present.

During the remainder of the winter patient improved to some extent, his red cells increased to 3,276,000, his hæmoglobin to 65 per cent., white cells to 7200, and nucleated cells disappeared. There was a relapse in June of 1899, and on July 31 the hæmoglobin was 23 per cent., the red cells 886,000, the whites 3500, and 392 nucleated cells were found per cubic millimetre, of which 308 were megaloblasts. Irregularity of the nucleus; poikilocytosis and polychromatophilia were marked. The physical findings were practically the same as when the patient was first seen six months before. He declined from this time on, and died the latter half of August. About two weeks preceding his death the patient had direct transfusion of six ounces of human blood by his own request. This was followed by no improvement in the blood, nor did hæmoglobin appear in the urine. Autopsy revealed the ordinary findings of a pernicious anæmia, including the fœtal bone marrow.

The color index diminished with improvement, but did not change to the degree often seen in other cases. This was probably due to the fact that the improvement was very slow, so that the hæmoglobin kept pace with the rise in the number of red cells. The leucocyte increase occurred with improvement, as is the rule, but there was only a slight leucocyte increase before death. The nucleated red cells were large in number, but did not increase to any great extent immediately preceding death, as was noted in Case III. The poikilocytosis and polychromatophilia corresponded in degree to the red count. The improvement wave lasted about five months.

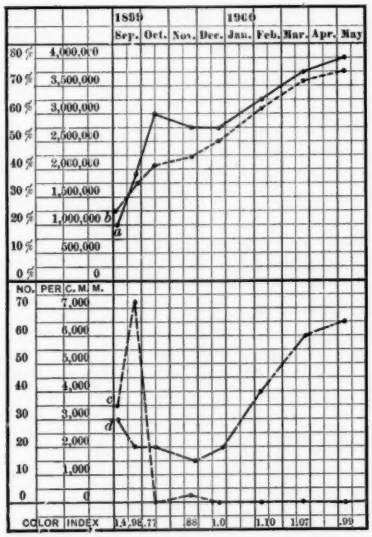
Case XII.—Female, aged sixty years. Has borne nine children. Seen first as a private patient on October 24, 1899. Family history good. Has had dyspepsia, with the formation of a good deal of gas at times for the last two years. For two years health has been failing. For six months had a dull, gnawing pain in the region of the stomach, not influenced by food. Has vomited two or three times a week for the last two or three months, and nearly every day for the last two weeks. No blood in the vomited matter. Appetite usually good. Bowels were constipated. Complained chiefly of weakness and want of endurance, palpitation of the heart, shortness of breath, with dizziness and faintness. There was some frontal headache and paræsthesia, especially of the lower extremities. There has been some loss of weight, from 165 to 130 pounds. There has been a gradually increasing pallor. Examination showed a yellow pallor with pale mucous membranes; pulse rapid, weak and compressible; capillary pulse in the lips. Heart-sounds were weak without murmurs. Abdomen and pelvis negative. The urine showed a slight trace of albumin, otherwise normal. The blood showed 32 per cent. of hæmoglobin, 2,100,000 reds, 8000 whites, and 49 nucleated red cells per cubic millimetre, of which 24 were megaloblasts. Irregularity of the nucleus; poikilocytosis and polychromatophilia present. Under restorative tonics the patient improved in strength, and on December 6th the hæmoglobin was 48 per cent., reds, 2,348,000; whites, 9000; nucleated red cells 8, of which 4 were megaloblasts. The patient lives in Iowa, and a relative has just informed me that she continued to improve until the first part

of March, but since that time there has been a return of the old symptoms, with increasing pallor, weakness, etc.

The color index rose with improvement, which was gradual, and the rise was therefore slight. The leucocytes were inconstant in number; the nucleated red cells decreased with the improvement, and the megaloblasts lost their preponderance over the other forms with improvement. The poikilocytosis and polychromatophilia corresponded with the red count.

CASE XIII. (See Chart III.)—Female, aged sixty years, copyist. Has borne two children. Was admitted to the Cook County Hospital on September 8, 1899. For six months the patient has complained

CHART III.



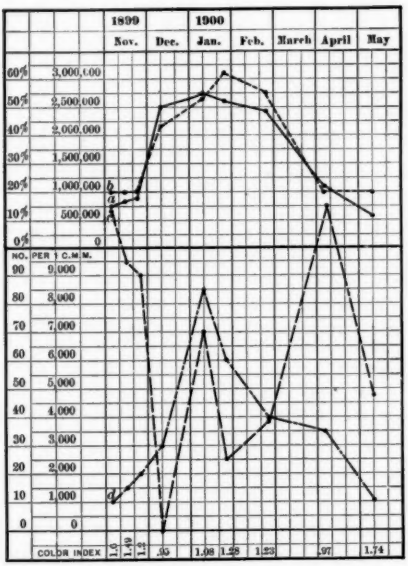
CASE XIII. *a*. Red corpuscles. *b*. Hæmoglobin. *c*. Nucleated red corpuscles. *d*. Leucocytes.

of weakness, faintness, shortness of breath, palpitation of the heart, coldness of the extremities, and general nervousness. She has had nosebleed twice. There has been no loss in weight, but the symptoms above enumerated have become so marked that she was obliged to go to bed. Examination showed a lemon-yellow pallor, with some œdema of the eyelids and of the ankles. Pulse was small, rapid, compressible and weak. A soft murmur was heard over the heart, transmitted into the vessels of the neck. A venous hum was also heard in the neck. The spleen was palpable, and the liver extended two finger-breadths below the right costal arch. The urine was normal, and the pelvis negative. There were no hemorrhages of the skin, and the retinæ were normal.

The temperature was elevated for the last two days following an attack of diarrhœa. The stool was watery and loose and contained no parasites. A blood examination showed 25 per cent. of hæmoglobin, 960,000 reds, 3000 whites and 36 nucleated cells per cubic millimetre, of which 12 were megaloblasts, 12 microblasts, and 12 normoblasts. Irregularity of the nucleus, poikilocytosis and polychromatophilia present.

Under restorative tonic treatment the patient improved rapidly, and on November 26th, just previous to leaving the hospital, the hæmoglobin was 44 per cent., red cells 2,736,000, white cells 1500, with 3 nucleated cells, all megaloblasts, present, with a continued but lessened poikilocytosis and polychromatophilia. The improvement continued. A blood examination made on March 21st gave hæmoglobin 72 per cent., red cells 3,720,000, and whites 6000; no nucleated cells, but poikilocytosis and polychromatophilia still present. In spite of the evident improvement in the blood, the patient complained of great weakness. She is undoubtedly at the top of an improvement wave.

CHART IV.



CASE XIV. *a.* Red corpuscles. *b.* Hæmoglobin. *c.* Nucleated red corpuscles. *d.* Leucocytes.

CASE XIV. (See Chart IV.)—Female, aged twenty-nine years, married. Has borne no children. Was admitted to the Cook County Hospital on November 3, 1899. The patient gives a negative history as to previous illness of any severity. Present illness began six months ago with diarrhœa in August and September. She has also had some cough with bloody expectoration. There has been shortness of breath

with palpitation, great weakness, dizziness on changing the position of the body suddenly, dimness of vision, some headache, and intercostal pain, and paræsthesia of hands and feet. Examination showed a lemon-yellow color without emaciation. The pulse was rapid and feeble. A blowing murmur was heard over the base of the heart, transmitted into the neck. There was no venous hum. The lungs, the abdomen, and the urine were negative; the stools were formed and no parasites were found. The blood examination showed hæmoglobin 22 per cent.; red cells, 744,000; white cells, 1000; 115 nucleated cells per cubic millimetre, of which 85 were megaloblasts. Poikilocytosis was very marked, and polychromatophilia was present.

Under restorative tonic treatment the patient improved gradually, as is shown by numerous blood examinations, until January 18, 1900, when the best condition prevailed. At this time hæmoglobin was 62 per cent.; reds, 2,650,000; whites, 6000; nucleated red cells, 24, of which 12 were megaloblasts; poikilocytosis much less than formerly, and only slight polychromatophilia. At this time the patient complained of soreness of the throat, and an examination showed a syphilitic gumma of the soft palate. She was placed upon large doses of iodide of potash and inunctions of mercury. The gumma rapidly disappeared, and the throat was healed within one month. From this date, however, the patient again declined in health, lost in weight and strength, had dizziness, dyspnœa, and palpitation on exertion. There was a murmur at the apex of the heart, and a very weak and compressible pulse. An examination, made on April 10th, showed hæmoglobin 20 per cent., a fall of over 40 per cent. in less than three months; red cells, 1,132,000; whites, 3500; nucleated cells 116 per cubic millimetre, of which 102 were megaloblasts; increased poikilocytosis and polychromatophilia.

This patient suffered from syphilis, although she denied all knowledge of acquiring the disease. What relation the syphilis bore to the blood state is questionable. Under anti-syphilitic treatment the blood became rapidly worse, but this is, of course, no proof that the blood state even of pernicious anæmia may not be caused by syphilis.

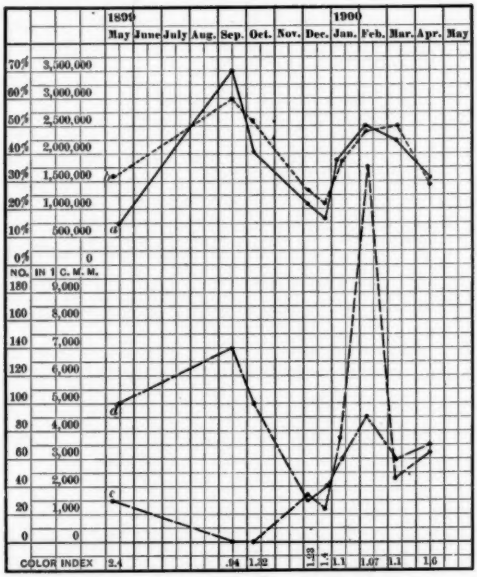
Following the rule, the color index fell with improvement in this case, but continued to fall with the decline. The leucocyte count corresponded in degree to the number of reds and the percentage of hæmoglobin. In this case, too, there was a flooding of nucleated reds before improvement, corresponding partially to von Noorden's law. The nucleated reds disappeared once during the stage of improvement, and increased again with the decline. The megaloblasts were in excess. The poikilocytosis and polychromatophilia corresponded to the number of reds. The improvement wave continued for about five months.

Case XV. (See Chart V.)—Male, aged forty-three years, married, an engineer, was admitted to the Cook County Hospital on April 19, 1899. Gave a negative history of tuberculosis and carcinoma in the family, and denied venereal disease. Was always healthy until present trouble. For two years has felt tired and weak, sleepy, and has been told that he looked paler than usual. Was annoyed by a pain and weight in the stomach, with eructations of gas after meals. Twenty-one months

ago gave up work and was in a hospital for three weeks. He again went to work after three weeks for about a year. During the last period, when at work, he was troubled with shortness of breath and palpitation upon severe exertion, and frequently had bleeding of the gums. Recently he has had no appetite; has had pain in the stomach after eating, and has vomited at times soon after the meal.

The bowels have been constipated. Examination showed a lemon-yellow pallor without much loss of weight, with general negative findings, including the chest, the abdomen and the kidneys. After a test meal no hydrochloric acid was found in the stomach contents, while

CHART V.



CASE XV. *a*. Red corpuscles. *b*. Hæmoglobin. *c*. Nucleated red corpuscles. *d*. Leucocytes.

lactic acid was in excess. A blood examination, made on May 20, 1899, showed 32 per cent. hæmoglobin, 726,000 reds, 5000 whites, 30 nucleated cells per cubic millimetre, of which 20 were megaloblasts, poikilocytosis and polychromatophilia.

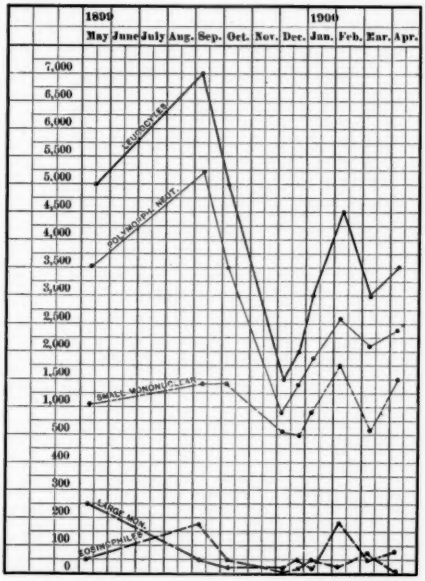
The patient improved until October, 1899, the red cells increasing to 3,500,000, and hæmoglobin to 60 per cent., the nucleated cells disappearing. Then there was a relapse, with a low ebb in December, when the hæmoglobin fell to 22 per cent., red cells to 880,000, the nucleated reds to 32 per cubic millimetre, of which 28 were megaloblasts, while poikilocytosis and polychromatophilia were very marked. Again, improvement occurred under restorative tonics and rest in bed until the latter part of

March, 1900, since which time there has been again a decrease in the hæmoglobin, in the red cells, and an increase in the nucleated reds, and in the irregularity of the cells, and increased polychromatophilia.

This man presented in every way a classic case of pernicious anæmia. His physical findings were negative. Frequent examinations of his stomach contents, after a test meal, showed the constant absence of hydrochloric acid, free and combined, and lactic acid always present, usually in large amount. He is at present upon the downward curve.

The color index was nearly always high, but fell with improvement, and increased with each decline. The nucleated cells disappeared in the

CHART VI.



CASE XV Differentiation of leucocytes in absolute numbers per cubic millimetre.

first improvement wave, and reappeared with the decline. They increased with the second improvement, amounting to a crisis. The first improvement wave lasted six months, the second about four months. Poikilocytosis was very marked, even when the reds were in largest number. Polychromatophilia varied with the number of reds.

The patient died on May 21, 1900. The death was not known to the writer for two weeks, and hence no autopsy was made.

CASE XVI.—Male, aged forty-eight years, married, a capitalist. Seen first on January 1, 1900, with Dr. Franklin Hays, of Indianapolis,

Ind. Gave an excellent family history, with good habits. Venereal disease denied. Has not been well since 1895, when he was almost suffocated by smoke while exhibiting an invention to protect firemen from smoke. Since then he has had suffocative attacks, with dizziness, and occasionally abdominal pain. Bowels have been constipated. He has lost in strength without loss of weight. There have been palpitation, shortness of breath on exertion, and dizziness when moving suddenly or under excitement. Appetite has been variable, and digestion usually good. Was in Europe in the fall of 1899, and a blood examination was made in London by Dr. Severs, which showed hæmoglobin, 25 per cent., reds 2,200,000, and whites 20,500. For the last six months there has been a more rapid decline in strength and endurance until at present the patient is confined to bed by extreme weakness.

Examination showed a very pale lemon tint without loss of weight. The pulse was small, quick, 108 per minute, the temperature 102 at the time of examination. A loud systolic murmur was heard over the præcordium, loudest in the mitral area. The second sound accentuated in pulmonic area. No murmur in the vessels of the neck. A few moist râles were heard on deep inspiration over the lower portion of the lungs behind. The abdomen showed the liver with normal area, the spleen palpable. Rectum, negative. A small nodule, the size of a navy bean, in the left epididymis. Eye-grounds, normal. The blood showed hæmoglobin, 15 per cent.; red cells, 912,000; nucleated cells, 21 per cubic millimetre, of which 14 were megaloblasts. Marked irregularity of nucleus, poikilocytosis present with polychromatophilia.

A blood examination, made June 6, 1900, showed hæmoglobin, 19 per cent.; red cells, 762,000; whites, 7000; nucleated red cells, 21 per cubic millimetre, of which 14 were megaloblasts and 7 normoblasts. Polychromatophilia and poikilocytosis present.

This patient presented every condition, as far as the appearance and physical findings go, of a pernicious anæmia, and although the color index is relatively low, the other conditions of the blood make the diagnosis practically certain.

Case XVII.—Male, aged forty-six years, married, American. Was seen on March 28, 1900. Negative history as to inherited disease; good habits; venereal disease denied. Lived in South Dakota for several years, and immediately preceding the present illness used the alkaline waters of that region to drink. Present illness began about fifteen months ago. He first noticed signs of weakness and lessened endurance, then had a rather severe serious diarrhœa. He noticed that the skin was yellowish and very pale. Since that time has had some fermentative dyspepsia, with diarrhœa off and on, the bowels usually loose.

During the first half of 1899 there was some improvement, when the patient came to Wisconsin to remain with his father's family. He gradually became weaker and was confined to bed in September, 1899, and had a severe watery diarrhœa. He lost some in weight. Again, there was improvement until the first of February, 1900. Since that time there has been a rapid decline of health, with weakness, palpitation of the heart, dyspnœa on exertion, and a suffocative feeling with post-sternal pressure, sometimes radiating to the arms when excited or when walking up stairs. In February, 1900, a blood examination made

by the Columbus Medical Laboratory of Chicago showed hæmoglobin, 37 per cent.; reds, 1,702,000.

Examination showed a well-nourished man as to weight, with a lemon-yellow pallor; pulse small, 130 per minute; heart area normal; a soft systolic murmur at the base and apex, the murmur transmitted into the neck. A loud venous hum in the neck. The lungs, the abdomen and the pelvis negative; slight œdema of the ankles. The retinæ normal; no petechial spots; the urine contained a great number of crystals of uric acid, but no abnormal ingredients. Blood examination showed hæmoglobin, 20 per cent.; reds, 701,200; whites, 4140; 32 nucleated cells per cubic millimetre, of which 24 were megaloblasts. Poikilocytosis was very marked, and polychromatophilia present. This case is one of undoubted pernicious anæmia.

The case shows a very low red count, and is remarkable in that the megaloblasts are very large, and show a very tense irregularity in shape of the nucleus, characteristic of extreme degeneration. Poikilocytosis was extreme. The patient died at his home in Wisconsin during the first half of April. No autopsy.

Case XVIII.—Male, aged fifty-five years, married, American, civil engineer. Seen April 1, 1900, with Drs. Staples and Hancock, of Dubuque, Iowa. Family history negative; venereal history negative. Good habits. His wife has borne no children. During the summer of 1899 patient noticed that his color was not as ruddy as formerly, and that he had lost energy and became fatigued quickly. Dr. Hancock found negative physical conditions except of the blood, which, on November 12th, gave 2,550,000 red cells. The hæmoglobin was not estimated.

Restorative tonics in the form of iron and arsenic were used, but the patient gradually lost ground. On January 2d, Dr. Hancock found red cells, 1,980,000, with many megaloblasts, and marked poikilocytosis. Patient's weight was 155 pounds, the usual weight for the last few years. He complained of great weakness and prostration. He had palpitation of the heart, ringing in the ears, and was dizzy when he changed the position of the body. Appetite was good until recently. The bowels were usually constipated. The patient had no pain. There was a lemon-yellow colored skin. Pulse was small, weak, and 80 to the minute. There was a soft systolic murmur heard at both the apex and base of the heart, loudest over the aortic area, transmitted into the neck. The second sound in both the aortic and pulmonic areas was accentuated. There was a venous hum in the neck. The lungs were negative; the spleen was negative; the liver extended from the sixth rib to one inch below the costal margin in the mammary line, and the edge was hard and resistant. The pelvis was negative; the reflexes, both deep and superficial, were normal; the urine was normal, with much uric acid deposited in crystals. Blood shows hæmoglobin, 20 per cent.; 1,674,000 reds; whites, 1146, with 5 nucleated red cells, of which 4 were megaloblasts. Poikilocytosis was very marked, and polychromatophilia was present.

On April 18th a blood count was made by Dr. Hancock, which showed hæmoglobin, 20 per cent.; reds, 1,342,000; whites, 1750, with many megaloblasts, and marked poikilocytosis. This case is an undoubted one of pernicious anæmia without discoverable cause.

The color index was below normal, but the nucleated red cells were very large and showed degenerative nuclei. A small white count is notable.

CASE XIX.—Male, aged fifty-two years, banker. Seen on April 13, 1900, with his physician, Dr. B. F. Landis. Family history excellent. Has never used alcohol or tobacco, and denies venereal disease. Has always led a sedentary life. No previous illness except the diseases incident to childhood. Two years ago first noticed lessened energy and strength, gradual decline without incident until the fall of 1899; then was very pale, weak, and without much energy or endurance. Remained up and about until the middle of March, 1900, but since then has been confined to bed.

Examination showed a lemon-color pallor without loss of weight. Pulse weak, 90 to the minute. Heart sounds weak; a systolic murmur heard loudest in the mitral area, and also at the base, transmitted into the vessels of the neck; a venous hum over the veins of the neck. Negative general findings as to liver, spleen, pelvic organs, and the eye-grounds were normal. Cutaneous sensations normal. The breath was fetid, and the tongue was covered with a white fur. Urine, normal. Blood showed 25 per cent. of hæmoglobin, reds, 156,000, whites, 5336, 26 nucleated red cells, of which 24 were megaloblasts. Poikilocytosis very marked, and polychromatophilia present.

June 9th, the blood examination gave hæmoglobin, 30 per cent., red cells, 999,000, whites, 3330, 10 nucleated red cells, all megaloblasts, per cubic millimetre.

The blood has improved somewhat since the first examination, but the patient appears the same, and feels no stronger.

The patient died June 16, 1900. No autopsy was allowed.

CASE XX.—Male, aged twenty-six years, single, American, was admitted to the Presbyterian Hospital, Chicago, June 1, 1900.

No tuberculosis or history of carcinoma in family. Denies venereal disease. Had the usual diseases of childhood before the fifteenth year. In 1890 had a severe attack of la grippe; not as strong as before that time.

Present illness commenced after an attack of la grippe in December, 1898. A year ago noticed weakness, lessened endurance, palpitation of the heart and dyspnœa upon exertion. Tingling, formication, numbness and coldness of feet and legs occurred in January, 1899, and have persisted.

Was told he was very pale. Did not lose in weight. Appetite and digestion remained good, and the bowels were usually regular. Had some fever, he thinks, during the afternoon on several occasions. Contracted a cold two weeks ago, and since that time has had a slight cough with some yellowish sputa.

On examination: bodily weight well preserved, skin very pale and lemon-yellow tint, mucous membranes very pale. Negative physical findings as to lungs, liver and gastro-intestinal tract. Urine, negative. Spleen, palpable. A blowing systolic murmur was heard in the mitral and aortic areas; not transmitted. A venous hum was heard over the large vessels of the neck. Pulse 100 per minute, quick and somewhat water-hammer in character. A capillary pulse in mucous membranes of the lips.

The knee-jerks absent. Cremasteric reflexes present. Skin of lower extremities respond to test for tactile temperature and pain sensations. Subjective paræsthesias of legs present. The blood showed red cells, 756,000, white cells, 3000, hæmoglobin, 30 per cent. No differentiation of white or red cells was made. June 15th a second blood examination gave reds, 980,00, hæmoglobin, 26 per cent., and whites, 8000. Poikilocytosis was very marked. There were 660 nucleated red cells per cubic millimetre, of which 400 were megaloblasts.

General Conclusions. Of the twenty cases, twelve were males, and eight females.

The average age was forty-four years, the youngest twenty-four, the oldest sixty-two.

No exciting cause could be found in any case.

There was no special relation to the use of alcohol, nervous shock, overwork, or to previous disease, excepting, possibly, in the one case in which syphilitic gumma of the soft palate occurred.

The symptoms were weakness, which was constant, and present in some degree even when the patient was at the top of the wave of improvement, and dyspnœa and palpitation occurred at some time or other during the course of the disease in every patient. Gastro-intestinal disturbance of some kind, usually fermentative dyspepsia with constipation or diarrhœa, was the rule. A few cases showed a constant tendency to diarrhœa.

The nervous symptoms were frequent, especially paræsthesias of the lower extremities, and headache, with dizziness, was common. Sleeplessness and restlessness occurred in the late stages of the fatal cases.

The lemon-yellow tint was present in every case. In the great majority of the cases there was preservation of the body weight.

Cardio-vascular disturbance was an invariable feature. In every case there was either a murmur over the heart or in the neck, and the radial pulse was weak and compressible.

There was splenic enlargement in five cases. The liver was palpable and enlarged in three cases. In only three cases were the stomach contents examined after a test meal; free hydrochloric acid was absent in all.

The temperature was elevated as a rule, but fever was never high, excepting a few days before death in some of the fatal cases.

A slight albuminuria occurred in five cases.

The stools were negative as to parasites in all but one. In this infusoria in large numbers were constantly present and associated with diarrhœa.

Hemorrhages in the skin, either petechiæ or ecchymoses, occurred in the majority of cases. Retinal hemorrhages, demonstrated by the ophthalmoscope, occurred in four cases.

The hæmoglobin varied from 15 to 74 per cent. (Fleischl), and the red corpuscles from 156,000 to 4,000,000. The color index in 53 of 66 observations was above normal. The lowest was 0.66, the highest 8 9 (?). Four cases showed the color index either constantly or usually low. In eight cases the low color index occurred at some time during the disease. The fall in the color index during rapid improvement took place in five of six cases, the corpuscular richness often becoming less than normal. The hæmoglobin in the course of time caught up with the reds. (See charts.) When improvement was gradual the increase in both elements was *pari passu*. The specific gravity bore a more constant relation to the number of red corpuscles than the hæmoglobin. During rapid improvement it was noticed that there was a tendency of the hæmoglobin to lag behind the other solids of the blood in their upward course. (See charts.)

The leucocytes on the average were below normal. They generally corresponded to the degree of anæmia, increasing during improvement and decreasing during decline. They increased in two cases just before death, a terminal leucocytosis.

A differential count (see Chart VI.) of stained specimens showed an average of 29½ per cent. of mononuclear cells, which is about normal. Very frequently there was a percentage increase of the small mononuclear cells. This would, at first glance, look like an absolute increase of the small mononuclears, and possibly account for the incorrect statements made by authors upon this point. The increase is only relative. It may be observed in these cases that the high percentage count of the lymphocytes was nearly always accompanied by a small number of leucocytes per cubic millimetre, thus bringing the absolute number of lymphocytes per cubic millimetre within the normal limits. What actually took place is a diminution in the number of polymorphonuclear neutrophiles, both relative and absolute.

The eosinophiles showed a disposition to increase with improvement and to diminish with the failing health, but this behavior was too fickle to enable one to formulate a rule concerning them.

The myelocytes were most abundant, broadly speaking, when the patient was low, but they appeared to be of little diagnostic or prognostic importance. These cases seem to show that the nucleated red cells are an essential feature of the disease. They were present in every case, although they often disappeared when the patient made a decided gain in health. The actual number was sometimes very large; in one case 10,336 per cubic millimetre, but more often it was small. The average number present in a cubic millimetre, with the exception of the case in which the number was so large, was 71. With this small number it often requires a prolonged search to discover them in the ordinary smear.

In individual cases a comparison of the number of nucleated red cells present from time to time was of considerable value, but when a small number was present it was not necessarily a favorable sign. Many subjects were characterized throughout by a scarcity of nucleated reds, and again they were diminished before death. The *quality* of the nucleated cells seems of greater significance than the number. The regenerative forms or normoblasts are of little consequence, but the degenerative forms or megaloblasts are very characteristic. In many cases they were present, and in fact the diagnosis could not well be made in their absence. The proportion of megaloblasts varied with the severity and stage of the disease, usually gaining a numerical ascendancy over the normoblasts when the disease was advanced. Irregularity of the nucleus in the normoblasts often means an attempt at division; in the megaloblast it is more often an incident in the process of degeneration and absorption of the nucleus. Megaloblasts, therefore, which have irregular nuclei, represent a greater degree of degenerative change than the ordinary variety. This peculiarity was noted in almost every one of the series, and often when other findings were not decisive. This variety of nucleus is probably seen rarely, if at all, in secondary anæmias.

Poikilocytosis was present in all cases, and in no case did it entirely disappear at any stage of the disease, including the period of greatest improvement.

Polychromatophilia was present at some time in all of the cases, but was not a constant factor during the course of the disease, and especially during the stage of improvement.

To my assistant, Dr. Joseph A. Capps, I desire to acknowledge much valuable aid in the collection of clinical data and in making blood examinations.

A REPORT OF TWO CASES OF FILARIASIS.

OPERATION FOR LYMPHATIC VARICES AND CHYLOUS HYDROCELE, WITH REMOVAL OF ADULT WORMS.[1]

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AND
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Filariasis is a parasitic disease which is very common in many tropical countries, in some of which it is a scourge. In northern countries it is rarely encountered, and its numerous manifestations, conse-

[1] Read at the meeting of the Association of American Physicians, Washington, D. C., May, 1900.

quently, are but little understood. It is probable that cases are repeatedly unrecognized.

The nature of the first case which is here reported was not recognized when he entered the hospital. The reasons are: First, because the disease was not suspected, and, second, because the lesions which he presented at that time were not characteristic, so that under repeated similar circumstances there would be no objective signs particularly suggestive of filariasis, and only a blood examination would be positive. Consequently, we have decided to present the features of these cases as we encountered them.

Case I.—On September 20, 1899, C. A., aged twenty-two years, entered one of the surgical wards of the Boston City Hospital with the history of sudden onset of pain across the small of the back while lifting a bale of paper. This pain increased in severity, so that at the end of half an hour he could not remain standing, nor could he lie in one position any considerable length of time. The pain extended around to the left groin and down into the left testis. There was a desire to urinate frequently, but micturition did not give any relief. He felt dizzy and nauseated, but did not vomit. His temperature was normal. The urine was normal. Physical examination was negative.

The condition of the patient at this time was not such as particularly to attract the attention of the visiting surgeon. Two days later all of his subjective symptoms had disappeared, and he was discharged from the hospital feeling perfectly well.

He resumed his work as a bookkeeper, but soon noticed that there was a swelling in the left side of the scrotum which extended up to the groin. This swelling disappeared on lying down. There was some discomfort when he was walking about; he got tired easily, and his condition was a source of worry to him.

On account of this swelling he entered the hospital a second time, and became a patient in the service of Dr. H. L. Burrell, and was then seen by the writers for the first time.

Sufficient examination was made to show that the left testicle was somewhat enlarged, but not tender, and that the cord was thickened by the presence of a mass of vessels which led to the external abdominal ring. On lying down these vessels decreased in size, and clinically corresponded to a case of varicocele. The external abdominal ring admitted the finger-tip readily, and there was a marked impulse and a slight hernial protrusion on cough.

His condition seemed to correspond to a varicocele complicated by a small inguinal hernia, and without particular attention being paid to his history, and without making further examination, he was prepared for operation. Under ether the usual incision for inguinal hernia was made and the cord exposed from the internal ring to the testis by drawing the latter toward the lower end of the four-inch incision. A small hernial sac was isolated and ligated, and the posterior wall of the inguinal canal restored in the usual manner. The cord itself was about the size of the index finger and was composed of about ten thick-walled tortuous vessels or tubes, in addition to the usual structures. There were two or three large veins to be seen which could be recognized by

their dark color, but the remaining structures were light-colored and about the size of the veins in a varicocele. They were considerably distended and their walls were thick. It was decided to excise this mass of vessels for the whole length of the cord, as in a varicocele operation. On dissecting this mass from the surrounding structures it was noticed that minute quantities of a thin, milky fluid appeared in the field of operation. Unfortunately at the time this fluid became mixed with blood and could not be collected. The appearance of this fluid and the color of the excised tubes were the features that first made us suspect that there was something unusual in this case. The hernia and varicocele operation was completed and the wound closed.

The patient recovered well from the operation and the wound healed by first intention.

Pathological Report of Excised Mass. Macroscopical examination by Dr. Howe: "The specimen consists of a mass of dilated vessels and some fat. It is 12 cm. long, 1 cm. across, and 0.5 cm. thick. The vessels have firm, thickened walls, and do not collapse on being cut across. The largest vessels have a diameter of 2 mm." Microscopical examination: "Dilated and thickened veins.

The future history shows that these structures were not veins, although they resembled them under the microscope, and some of them contained blood. At the time of operation we felt certain that they were not veins on account of their light color when contrasted with veins near by, and the escape of small quantities of milky fluid.

Progress of Case—December 5th. Stitches out, linear scar healed by first intention; no redness, tenderness, or induration. For two weeks longer the patient remained in bed and wore a protective dressing. Meanwhile there was a gradually increasing swelling of the left side of the scrotum, which was examined carefully on December 19th.

The skin of the scrotum was normal, and consequently showed no signs of redness or thickening. The swelling was larger than a hen's egg and globular. It was smooth, fluctuant, and not tender, and transmitted light as freely as an ordinary hydrocele. At the upper end of the tumor could be felt the stump where the cord was excised. The tumor was aspirated with the following result:

Pathological Examination by Dr. Low. "Specimen consists of about 90 c.cm. of opaque, chrome-colored fluid, which microscopically shows large numbers of embryo filariæ in active motion. There are numerous small round cells, a few red blood-corpuscles and oil globules, and a large amount of fatty granular material."

Chemical Examination by Dr. Ogden. "Reaction neutral; specific gravity, 1018; albumin, 1.5 per cent.; fat, 1.53 per cent; chlorine, 1.95 per cent. The fluid was completely clarified by shaking with ether after the addition of sodic hydrate. Diagnosis: Chyle in an inflammatory serous fluid."

19th, 7 P.M. Blood examination shows many filariæ. Differential count of leucocytes made by Dr. Steensland:

Small lymphocytes		35.33 per cent.
Large lymphocytes	3.00	
Transitionals	0.67	3.67 "
Polymorphonuclear leucocytes		56.67 "
Eosinophiles		4.33 "
		100 per cent.

300 leucocytes counted.

20th. Blood from ear examined at 3.15 P.M.; no filariæ found in four slides. 5.15 P M. Patient has been in bed one hour; seventeen filariæ counted, with the aid of movable stage, in each of two large drops.

The diagnosis was now firmly established and the obscure features of the case were easily explained.

At the time of operation he had a small inguinal hernia. The condition resembling varicocele was a collection of dilated and thickened lymph vessels, which extended into the testis, thereby increasing its size.

There was no fluid in the tunica vaginalis testis until after the operation, and its appearance is readily explained by the fact that most of the return lymph vessels had been excised. The tumor in the scrotum following the operation was a chylous hydrocele, for the most part, but was also due to the increasing size of the testis in consequence of the dilating of the obstructed lymph channels.

Previous History. It was known at entrance that this patient had lived on the Island of Barbadoes, and when questioned as to his past history, he said nothing about any previous sickness, and there was nothing observed that led us to suspect that we were dealing with a case of filariasis. The disease is so rare in northern latitudes that it is not suspected and its clinical manifestations are but little understood. The commoner symptom—chyluria—was absent, and the urine was normal. Furthermore, the patient, who is a fellow of considerable intelligence, knew that he had suffered from filariasis, but said nothing about his past history because he thought his present condition had nothing to do with any previous sickness. We then obtained the following history:

He was born on the Island of Barbadoes in 1878, where he lived for seventeen years. He was on his way to school one morning in September, five years ago, when he was seized with sudden pain across the lower back and lumbar regions and also in the left groin. It was so severe that he thinks it caused him to faint. He was carried home and put to bed. This is the first sickness that he can recall. This attack of pain was followed by a chill, which, in turn, was followed by others. There was more or less nausea and headache. He was given quinine and arsenic for a period of three months, and remained in bed for five months. During that time he was not very sick, but suffered mostly from weakness and debility. He had recurrent febrile attacks, during which the glands in the left groin were swollen and the left testis was enlarged. The glands remained swollen for about three months, but the testis became permanently enlarged. Chills and febrile attacks lasted about three months, with decreasing severity. During this period he was troubled with persistent drowsiness by day. Even up to the time of operation drowsiness has been a feature in his case. His attack was diagnosed at the time as "Barbadoes fever," also called "fever and ague," and was understood to be due to filariæ. He remained in bed for such a long period, although not very sick, on account of the prevailing opinion that lymph scrotum and elephantiasis are thus avoided.

Ten months after the first attack he had a second one, which came on suddenly, and he was more or less prostrated for a month. The swelling of the left inguinal glands recurred, accompanied by the same constitutional symptoms. This time the glands were tender and the skin over them reddened. The testis gained in size, but became smaller later. He was not allowed to walk during this month.

On recovering from this attack he went to Montreal, Canada, and continued to go to school for about two years. Then he went to New York, served a brief period as a bookkeeper, and enlisted in the militia, and then spent some months in South Carolina. Somewhat over a year ago he came to Boston, where he was occupied as a bookkeeper.

During this period of about four years since leaving the Barbadoes he has never been perfectly well and strong, but he has never had a severe attack similar to those from which he suffered at home. On an average of about once a month he would have a chill, followed by moderate fever for a few days. There would be a dragging sensation in the left groin, but no particular pain, and he felt languid and unable to work. At times there was pain in the back. It was one of these attacks that caused him to enter the hospital in September, but as he attributed the condition to heavy lifting, and was apparently well in two days, the true cause was not detected.

On leaving the hospital he resumed his work, but found that he got tired easily and could not work regularly, and was becoming discouraged. He had made up his mind to return to Barbadoes, when he had another attack of pain in the back and left groin, followed by increased malaise and mental depression, and he entered the hospital again, when we saw him for the first time. All of this history, however, he carefully avoided telling us, thinking that it had nothing to do with his present complaint.

21*st. Second Operation.* Having established the diagnosis beyond question, he was advised to have this whole tumor mass in the left scrotum removed, if thought advisable at the time of operation, and he readily consented. On the morning of the operation there were no embryos found in the blood. The skin of the scrotum was still perfectly normal and the inguinal glands were not enlarged nor tender. The tumor mass, which consisted of the left testis, together with some fluid in the tunica vaginalis, was not tender.

Under ether narcosis the original incision was extended a short distance on to the scrotum, the skin dissected from the tumor, and the whole mass removed without cutting into any part of it. The wound was closed without disturbing the site of the first operation. At 9 P.M. no embryos were found in the blood.

So far as the wound was concerned the patient made an uninterrupted convalescence.

Examination of the Excised Tumor. The specimen consists of a testicle with the intact sac of the tunica vaginalis. The mass is ovoid in shape, 10 cm. long, 6.5 cm. wide, 4.75 cm. thick. The sac contains about 50 c.cm. of a yellow semi-opaque fluid. The tunica vaginalis is smooth and glistening. The parietal layer is slightly thickened and semi-opaque. The spermatic cord at the point sectioned is 1.5 cm. in diameter. Near the testicle it enlarges greatly, measuring 5 cm. in thickness. Between the cord and the globus major is a soft wedge-shaped mass, 3 cm. in width, composed of translucent distended vessels and œdematous fat. The testicle weighs 80 grammes. The globus major is greatly enlarged, measuring 3 cm. in width. It is soft, almost gelatinous, and its surface is marked by tortuous dilated lymph vessels averaging 1 mm. in width. The globus minor and the body of the epididymis are nearly of normal size. The testis propria measures 5.5 x 4 x 3.5 cm. It is very œdematous. The tubules tease out readily. The testicle

is sectioned in its long diameter. After a few minutes' inspection of the cut surface a writhing coil, 6 mm. in size, is discovered upon the body of the epididymis. A single thread 1.5 cm. long extends from this mass across the mediastinum testis. A free end projects from the top of the coil. Half a centimetre nearer the inferior border of the testicle is a smaller mass. The worms are white, opaque, and thread-like. When the testicle is immersed in warm, normal salt solution the writhing and the coiling of the worms is quite active. When detached from the surface by gentle manipulation they quickly anchor themselves to the surface again. Another tightly coiled bunch is soon seen gradually to rise into view near the mass first discovered.

FIG. 1.

Female filariæ Bancrofti, twice natural size.

I. and II. Two coils as they appeared on the cut-surface of the testicle. Each consists of a single female worm, somewhat mutilated; their bodies have been cut in two and the uterine tubes and digestive tract have been extruded. III. Complete female worm.

It was subsequently found that this third mass consisted of six worms, two males and four females. One of the males was complete. Of the others only their heads and portions of their bodies, varying from 1 to 4 cm. in length, were obtained.

In salt solution the movements of the worms continued over six hours —*i. e.*, until 11 P.M. The next morning all were dead.

The two masses first discovered presented the appearance shown in Fig. 1. They were carefully detached from the testicle and preserved in 5 per cent. formalin. Each mass consists of a single female

worm. The pointed, tapering anterior end is well shown in Fig. 1, I. When the testicle was incised the bodies of these worms must have been cut and the prolapsed uterine tubes and digestive tract then became inextricably intertwined with the coils.

The following morning an entire female worm was discovered by Dr. Mallory on the outer surface of the testicle. It had evidently crawled out of the tissue into the warm salt solution. When found it presented the appearance shown in the photograph (Fig. 1, III).

22*d*, 5 P.M. A few filariæ found. Blood examination by Dr. Steensland: 8000 leucocytes, 6,016,000 red blood-corpuscles.

Differential count:

Small lymphocytes		38.2 per cent.
Large lymphocytes	0.2	
Transitionals	1.2	1.4 "
Polymorphonuclear leucocytes		55.8 "
Eosinophiles		4.6 "
		100 per cent.

500 leucocytes counted.

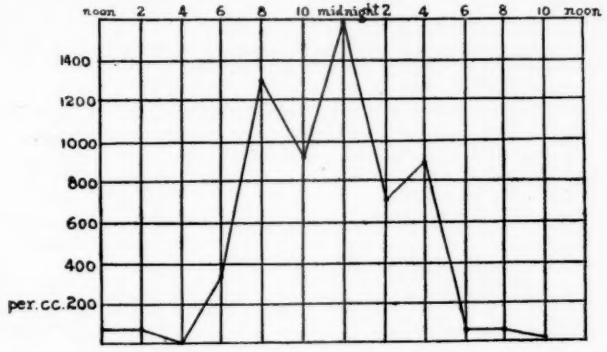
23*d*, 8.30 P.M. Fourteen filariæ found in one drop of blood, eleven in another.

Hæmoglobin	93 per cent.
Leucocytes	7400.

26*th*. Patient is suffering from pain in the right ear, from which there is a moderate amount of serous exudate escaping. Diagnosis: Acute otitis media. No embryos found in the exudate.

30*th*. Feces examined; no Charcot-Leyden crystals or other abnormal constituent found.

FIG. 2.



Number of filariæ in cutaneous circulation.

A simple method was devised for obtaining drops of blood of known size. A Thoma-Zeiss pipette for red corpuscles was used and blood drawn up to the mark 1 on the pipette. Then the blood was blown out upon a cover-slip.

The "red counter" had a capacity of 1.2 c.cm. when filled to the mark 101. Hence, the standard drop we used contained 11.9 c mm. of blood.

The average number contained in two drops was taken, and the number of filariæ in each c.cm. of blood calculated.

31*st*. At 8 P.M. the blood contains 438 filariæ per c.cm.

January 3*d*. Beginning at noon yesterday, two hourly counts were made for a period of twenty-four hours by Drs. Low, Fulton, and Steensland. The accompanying chart (Fig. 2) shows the nightly increase and decrease of filariæ in the peripheral blood. One slide, made at midnight, contained twenty-five filariæ, the equivalent of 2100 per c.cm. This is the largest number we have ever found.

The ear has become normal in every respect.

9*th*. Leucocytes, 3500.

Differential count:

Small lymphocytes		37.0 per cent.
Large lymphocytes	4.0	
Transitionals	4.5	8.5 "
Polymorphonuclear leucocytes		51.0 "
Eosinophiles		3.5 "
		100 per cent.

200 leucocytes counted.

15*th*. Patient discharged from hospital. The wounds are healed firmly, and there are no signs of any trouble at the site of operation.

June 1*st*. Patient rested a month after he left the hospital, and gained strength rapidly. For the last three or four months he has been working as an orderly at the hospital—a position which requires heavy lifting and considerable hard work.

Since the operation he has worked regularly. He has had no recurrence of the old pains in the back and left groin, nor have the chills recurred. He has gained in strength, and is no longer troubled with periods of general weakness, malaise, and mental depression.

The embryos still persist in his blood.

CASE II.—This man is a younger brother of the patient just considered, and he was asked by us to come for an examination more from curiosity than with the idea that embryos would be found.

He is twenty-one years old, was born in Barbadoes, and left the island with his brother, and they have been together more or less since. As a rule, he has always enjoyed good health and has always been able to go about and attend to his work. He has never had malaria, but occasionally he has suffered from what he calls "bilious attacks." He has never had any symptoms or manifested any objective signs which could with any degree of certainty be attributed to filariasis. The patient walked to the laboratory, at 8 P.M., and the examination was made at once.

It was found that his blood contained numerous embryos of the filaria nocturna, showing that adult worms must be present in his deeper lymphatics, although there is no clue as to their location.

He feels perfectly well in every respect, and his case has not been studied further.

HISTORY. Demarquay[1] discovered in Paris, in August, 1863, the embryos of filaria Bancrofti. The patient, a young man, a native of Havana, suffered from a chylous hydrocele, in the fluid of which the filariæ were found. Lemoine, who made the microscopical examination, writes as follows: "Mais l'attention fut surtout attireé par un animalcule de forme allongée et cylindrique. Les quatre cinquièmes antérieurs du corps avaient á peu pres la même diamètre. Le cinquième postérieur allait s'effilant de plus en plus et se terminat par une extrémité excessivement fine. Ce ver présentait des mouvements extrêmement vifs d'enroulement et de déroulement dans ses diverses parties et surtout dans son extrémité terminale." Demarquay's paper is accompanied by an admirable picture of the embryos.

The credit of the discovery is usually wrongly ascribed to Wucherer,[2] who, in Bahia, Brazil, in August, 1866, found embryos in the urine of a case of tropical chyluria. In 1868, Salisbury,[3] in the United States, found the ova in the urine. Lewis,[4] in India, in 1872, discovered embryos in the blood of man, and noted that their presence was generally associated with chyluria and lymph scrotum. He proposed the name filaria sanguinis hominis.

Much of our knowledge of the life-history of the parasites is due to the really brilliant discoveries of Patrick Manson, whose scientific studies in this field have embraced a period of over twenty years. In 1878, Manson[5] discovered that the mosquito was the immediate host. This idea occurred almost simultaneously to Bancroft and Manson, but to the latter belongs the credit of demonstrating its truth. Manson found that the filaria embryos, ingested with the blood, develop in the stomach of the female mosquito. The mosquito seeks stagnant water in which to deposit her eggs; when death occurs the filariæ are liberated, and if the water be drunk they pass into the human body.

Lewis[6] confirmed Manson's discovery and described and depicted the development of the larvæ in mosquitoes. He showed that some of the filariæ pierced the walls of the mosquito's stomach and underwent developmental changes in the abdominal and thoracic tissues. Low[7] has recently made the important observation that the filariæ migrate to the head and proboscis of the mosquito. He infers from this that when the mosquito next feeds on man the filariæ enter the human tissues.

It was these observations upon the mosquito that led Manson[8] to suggest to Major Ross, in 1896, that it might also be the intermediate host of the malarial parasite.

Filarial periodicity was discovered by Manson.[9] He found that the embryos were present in the peripheral circulation only during the night. He believes this periodicity is an adaptation to the habits of the mosquito.

Mackenzie[10] showed that if the patient's habits were reversed, so that

he slept by day and worked by night, the filarial migration was reversed. Mackenzie gives a chart of the filarial curve, showing the daily rise and fall most graphically. A blood examination was made every three hours, day and night, for a period of ten weeks.

Manson[11] has recently been able to demonstrate that filariæ when absent from the cutaneous circulation are lodged in the larger blood-vessels, especially of the lungs.

In addition to the well-known filaria sanguinis hominis of Lewis there are a number of other species. Six have now been described. Manson[12] has named the original hæmatozoan of Lewis, filaria nocturna; the others he calls filaria diurna, filaria perstans, filaria Demarquaii, filaria Ozzardi, and filaria Magalhaesi.

The filaria nocturna and the filaria perstans are the only ones that are thought to be pathogenic. In 1891, Manson[13] found the embryo form of filaria perstans in the blood of a negro from the west coast of Africa. It observes no periodicity, being found in the peripheral circulation both day and night. It is much smaller than the filaria nocturna and differs somewhat in structure. The adult worm was discovered by Daniels[14] in British Guiana in 1898. Manson regards the filaria perstans as the possible cause of the sleeping sickness of the negroes of the west coast of Africa, and the skin disease craw-craw.

The most important of these parasites is the filaria nocturna. The adult form of this organism was not discovered until 1876. On December 21st of that year Bancroft, of Brisbane, Australia, found the female worm in a lymphatic abscess of the arm. In July, 1877, this fact was announced by Cobbold[15] in the *Lancet*. Cobbold named the parasite the filaria Bancrofti, in honor of the discoverer.

Filariasis is widely distributed throughout tropical and subtropical countries. It occurs in a large part of China and India, in Japan, Australia, and the South Sea Islands. Thorpe[16] has shown that 32 per cent. of the inhabitants of the Friendly Islands are affected. Strube[17] found the embryos in the blood of negroes from the Transvaal. The disease occurs in Spain, and is very common in Brazil and the West India Islands. Guitéras,[18] in 1886, called attention to the existence of the disease in the Southern States. He found four cases in Key West and one in Charleston, S. C. De Saussure,[19] in 1890, published a report of twenty-two cases he had observed in Charleston. The city had been in constant communication with the West Indies, and doubtless the disease was introduced into this country from those islands.

Filariasis occurs particularly along the Gulf and South Atlantic coast. Many of the cases have been imported into this country, but in 1888, Mastin[20] reported an indigenous case in Mobile. De Saussure's twenty-two cases were of this nature. Slaughter[21] recorded, in 1891, two cases indigenous to the northern part of Virginia. Dunn[22] recently

found the filaria embryos in a woman who had always lived in Pennsylvania.

So far as we know, the adult worms have never hitherto been found in this country.

Specimens of Adult Filaria Bancrofti Previously Found.

Bancroft, in a letter to Cobbold,[23] dated from Brisbane, Queensland, April 20, 1877, said: "I have now obtained five specimens of the worm. . . . The worm is about the thickness of a human hair, and is from three to four inches long. My first specimen I got on December 21, 1876, from a lymphatic abscess of the arm--this was dead. Four others I obtained alive from a hydrocele of the spermatic cord, having caught them in the eye of a peculiar trocar I use for tapping. These I kept alive for a day, and separated them from each other with great difficulty." The worms were preserved in glycerin and sent to Cobbold, who described them. They were all females; only one of them was tolerably perfect.

On August 7, 1877, Lewis[24] found in a blood-clot from a lymph scrotum, after a continuous search for eight hours, portions of a male and a female worm. The male worm was torn across in two places, and the terminal ends were missing, and the tail of the female could not be found. The male was twisted about a portion of the female and was separated only with difficulty.

On November 12, 1877, dos Santos,[25] in Brazil, found five adult females in a lymphatic abscess of the arm; only one worm was complete.*

In 1881, Manson,[9] in Amoy, China, opened an abscess of the thigh, and, by passing a needle rapidly through some dark, grumous clots that escaped with the pus, succeeded in finding three or four fragments of a female worm.

In the same year he found a female filaria in a dilated lymphatic in a case of lymph scrotum. On attempting to withdraw it the body snapped across. The specimen of lymph scrotum, with half the worm *in situ*, was shown at the London Pathological Society.

In 1888, Sibthorpe,[26] of Madras, India, found two worms—a male and female—upon the cut surface of a lymph scrotum. The specimens were studied by Bourne. The tail of the female was wanting. The male specimen was about an inch and a quarter long (3.1 cm.). The anterior extremity was not present. The male worm showed a great tendency to coil.

* We doubt somewhat whether the filariæ which dos Santos found belonged to the species under consideration. His description does not conform with that of the filaria Bancrofti in all details. In deference to the opinion of such an authority as Cobbold,[25] however, we have included this case.

In 1894, Maitland,[27] of Madras, India, removed some thickened tissues from the inner surface of the left upper arm of a man who a short time before had suffered from lymphangitis in that region. Two operations were performed. The tissues removed were macerated in a mixture of nitric acid and chlorate of potash. In the lump first removed seven adult worms, and in the second, one, were found. Three of these were males and five females. "Those first discovered were coiled up together in a mass, and appeared as if lying in a lymphatic channel, but owing to the maceration of the tissues it was difficult to be certain of this. . . . An interesting point in the case just related is the great number of the parasites that were found, and also the fact that they appeared to be all intimately associated with one another. So far as we know, such a large number of these parasites have never before been found in one individual, nor have they been found coiled together in one mass as a number of these were." Maitland mounted six of the worms in balsam and sent them to Manson, who described and identified them. The tails of two of the females were missing, but the three males were complete.

Huber[28] states that Czerny found a living female filaria in the ovary of a woman from Rio de Janeiro. In 1897, Young,[29] in London, removed a hard, nodular mass from the arm of a young sailor, a native of Jamaica, who had lived in the West Indies, the United States, and Canada, who suffered from lymph scrotum and varicose groin glands. After several hours' examination of the tissue he noticed lying across his forefinger "a long white thread about the size of a horsehair." It proved to be a female filaria. Later the man committed suicide. An autopsy was performed. From a cut in a lymphatic of the right groin a small bundle was seen to emerge, looking like a tiny coil of very thin catgut. This was unravelled in normal saline solution and proved to consist of heads and part of the bodies of three female filaria Bancrofti. In the lymphatics of the right spermatic cord six more female worms were found, all more or less mutilated in the dissection. In the left spermatic cord seven worms were found. One of these was a male; it was an inch and a half long (3.75 cm.). It was in four pieces, and the tail was not discovered. Thus, in all, seventeen worms were obtained. Only one of these was a male.

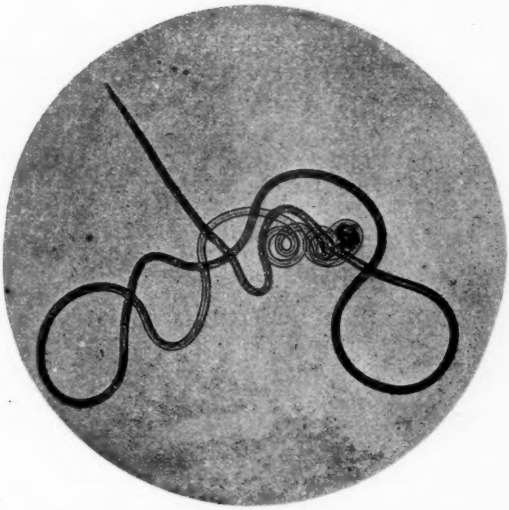
In the case here reported nine worms were found in the lymphatics of the epididymis. Two of these were males. One of the males and one of the females were complete. The others were more or less mutilated.

Altogether we have collected eleven cases in which the adult filaria Bancrofti was discovered. In these cases fifty-one specimens of the worm have been found and studied. Forty-three were females; eight were males. The worms have rarely been found intact and complete.

Lewis, in 1877, was the first to discover the male. Both the tail and the head were missing in his specimen. Sibthorpe found the male again in 1888. The tail was present, but the head was gone. Maitland, in 1894, obtained three complete males. Young, in 1897, found a mutilated specimen. In our case two males were found, one of which was uninjured.

Location. The worms have been found three times in a lymph scrotum (Lewis, Manson, Sibthorpe). Once in hydrocele fluid (Bancroft). Once in the epididymis (case reported by the writers). Once in the ovary (Czerny). Once in the spermatic cord (Young). Four

Fig. 3.



Adult male filaria Bancrofti. Magnified 10 diameters.

times in the arm (Bancroft, Maitland, Young, dos Santos). Once in the leg (Manson). Thus we see that in seven of the eleven cases the worms have been found in close relation to some part of the generative system.

In 1886, Magalhaes,[30] of Rio de Janeiro, found two adult worms—a male and female—in the left ventricle of the heart. He regarded them as filariæ Bancrofti. They are twice as long as the filaria Bancrofti, and differ in structure. Unfortunately, the description of Magalhaes filaria has crept into some of the best text-books of helminthology and medicine under the heading of the filaria Bancrofti.

Description of the Adult Worms. The male worm is shorter than the female. The intact specimen is shown in Fig. 3, magnified

ten times the natural size. The tail has a tendril-like twist, and the end is rounded and blunt. The worm is 3.86 cm. long; the body is 0.120 mm. in diameter; the head, 0.051 mm.; the neck, 0.043 mm.

The female measures between 7 and 9 cm. in length. The anterior extremity is tapering, but under the microscope the head is seen to be somewhat club-shaped. The mouth is unprovided with papillæ. A transverse section of the head and neck resembles somewhat the shape of a Maltese cross. (Fig. 4.) The diameter of the head is 0.068 mm. The diameter of the neck 0.051 mm. The diameter of the worm is greatest near the middle of the body, where it measures 0.240 mm.

Fig. 4.

Fig. 5.

Fig. 6.

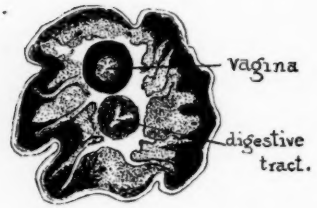
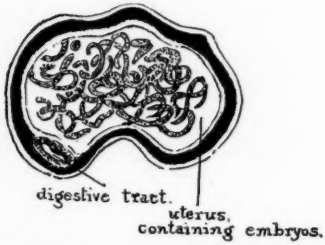


Fig. 7.



Cross-sections of an adult female filaria Bancrofti. Highly magnified.

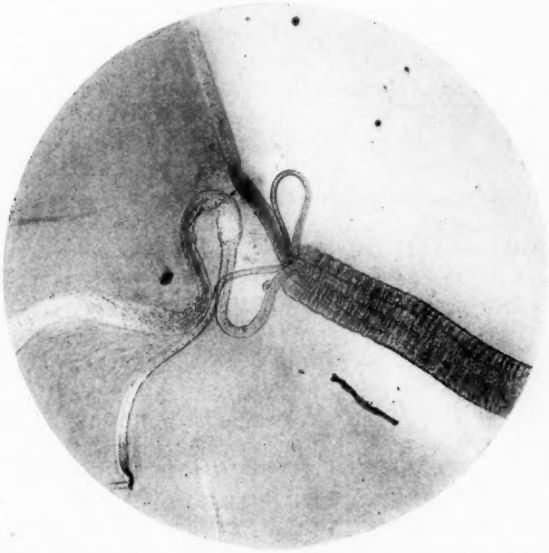
Fig. 4, head. Fig. 5, body, 0.64 mm. from anterior end. Fig. 6, body, 1.26 mm. from anterior end. Fig. 7, body, anterior to bifurcation of uterus.

The surface is slightly irregular. During life transverse striations or corrugations were visible. These were probably caused by contractions of the subjacent muscular wall. The mouth is situated in the centre of the anterior end. (Fig. 5.) The vagina opens near the head, the distance varying from 0.72 mm. to 1.3 mm. in different specimens. (Fig. 6.) The anal orifice is near the tip of the tail, which is rounded and blunt.

The anatomy of the worm is best studied in serial sections. Portions of different worms were embedded in celloidin. Transverse sections were cut and stained with hæmatoxylin and eosin. The digestive tract

passes down in the centre of the worm until the vagina is reached. The two tubes then run side by side. Lower down the greater part of the worm is occupied by the uterus, and the digestive tract is situated in the musculo-cutaneous wall. (Fig. 7.) The vagina is 2.4 mm. long, and has a thick, homogeneous wall. The uterus is composed of two thin-walled tubes which unite anteriorly. These tubes and the digestive canal are intertwined so that they have a braided appearance. The uterine tubes are of equal size, thin and structureless. The digestive tube appears about one-third the size of the uterine tubes in the fresh

FIG 8.



Portion of an adult female filaria Bancrofti, showing the digestive tract and the two uterine tubes extruded from the cut end. Magnified 38 diameters.

specimen, and presents a granular appearance. The uterine tubes (Fig. 8) are filled with ova and embryos in various stages of development. The ova average 0.035 mm. in size. The smaller embryos are coiled up and surrounded by a thin, structureless membrane—the chorion —and measure 0.050 to 0.060 mm. in their long diameter.

Manson found that the females were brown, while the males were colorless. The specimens, however, upon which he based this statement had been removed from tissues macerated in a mixture of nitric acid and chlorate of potash and then mounted in Canada balsam. All our worms were white and opaque and resembled white threads. But we

have noticed that when portions of the female worms were placed in impure alcohol, or salt solution, or became somewhat dried, that the walls of the uterine tubes assumed a brownish hue, giving the worms the appearance described by Manson.

Bourne,[31] and later Manson, showed that the tail of the male is provided with two spicules, which are retracted within the cloaca. In our complete worm, owing to the coiling of the tail, it was not possible to demonstrate the presence of these spicules without danger of mutilating the specimen.

Some authors lay stress upon the fact that the males show a great tendency to become coiled. This is doubtless true. But the female worms also may twist themselves into inextricable coils.

Pathological Changes in the Tissues. Tissues were hardened in Zenker's fluid and in 10 per cent. formalin. The greater part of the wall of the thickened lymphatics is composed of muscle tissue. This is beautifully shown in preparations stained with Mallory's connective-tissue stain. The endothelium appears normal. Between it and the muscle tissue is a layer of connective tissue, and surrounding the groups of muscle bundles are large bands of connective tissue which pass from the intima to the adventitia. There are no areas of degeneration.

Sections stained with Weigert's elastic-tissue stain show many delicate elastic threads surrounding the muscle bundles. In the intima is a marked new formation of elastic tissue. The elastic fibres are arranged in loops extending from the media to the endothelium of the intima.

We have seen a similar process of muscular hypertrophy in the dilated and thickened veins of varicoceles. Soboroff,[32] many years ago, stated that he observed a constant hypertrophy of the muscle fibres of the media in varicose conditions of the veins. But the remarkable muscular hypertrophy that occurs in many cases of varicocele has received but little attention from recent writers. The new formation of elastic tissue in the walls of the lymphatics is analogous to that recently described by Janni[34] in varicose veins.

Although all parts of the testicle, epididymis, and spermatic cord were examined histologically, the adult worms were found only in the body of the epididymis.

Sections through the tissue upon which the mass of adult worms had been discovered showed portions of one or more female worms lying in large lymphatic spaces five to ten times the diameter of the worm. The small digestive tract and the larger uterine tubes are readily demonstrable. There are no signs of inflammatory reaction in the walls of the lymphatics that contain the worms.

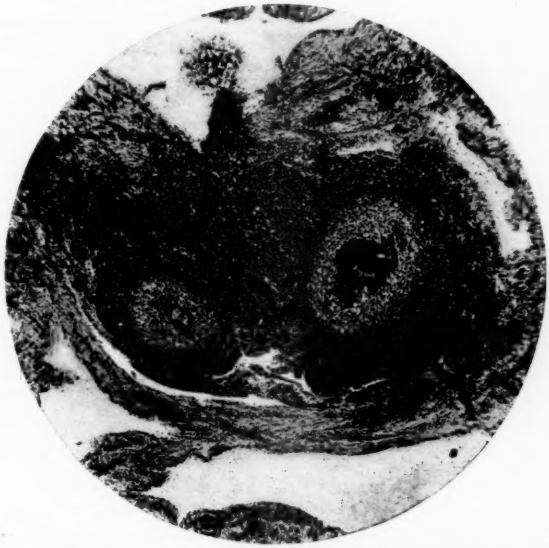
In some of the lymph vessels are embryo filariæ. Throughout the fibrous tissue between the lymphatics are numerous foci of lymphoid cells. It is interesting to note in this connection that Dr. Steensland

found an increase in the number of small lymphocytes in each of the three differential blood counts that he made.

One large lymph vessel is almost completely obliterated by a mass of granulation tissue, in the interior of which are apparently two portions of an encysted necrotic worm. (Fig. 9.) With the exception of a clear zone immediately around the worm the ingrowth is densely infiltrated with lymphoid cells and eosinophiles.

A search of the literature reveals only one case in which an adult filaria has been found in the tissues on histological examination.

FIG. 9.



Large lymphatic vessel nearly occluded by an ingrowth of granulation tissue and containing two portions of an adult filaria Bancrofti. Magnified 38 diameters.

Marie[34] discovered a dead female worm in an inguinal lymph node removed from a man affected with filariasis. The worm was surrounded by pseudotuberculous tissue.

Our observation explains one method by which the large lymphatic vessels may be occluded and lymph stasis produced. A worm dies and gives rise to a thrombus, which, as a rule, probably only partially blocks the vessel, as the lumina of the dilated lymphatics are many times the diameter of the worm. Later a growth of connective tissue extends from the wall of the vessel into the lumen. It surrounds the dead worm and obliterates the lymph channel.

It is not at all impossible that the lymph stasis may also be produced in other ways. Manson found ova in a lymph node. These he assumed were discharged prematurely from an adult worm, and having a larger diameter than the embryos they would block the minute branches into which the afferent lymphatics break up in the lymph node.

It is known that the worms may live for many years in the body. Our patient left the West Indies four years before the time of operation. Hence, the live adult worms were at least four years old.

Description of the Filaria Embryos. The embryos measure 0.260 to 0.300 mm. in length, and 0.006 to 0.008 mm. in breadth. Their anterior end is rounded. Their tail is pointed. It is enclosed in

Fig. 10.

Photomicrograph of a living filaria embryo in hydrocele fluid. Magnified 250 diameters.

a thin, transparent sheath which is much longer than the worm. Rarely the filaria can be seen moving forward and backward within its sheath. The collapsed sheath extending beyond the head often appears like a single waving cilium lashing the red blood-corpuscles at some distance —0.030 to 0.040 mm.—in advance of the head. The embryos are in constant motion, writhing, coiling and uncoiling, but they never exhibit a true progressive movement. (Fig. 10.)

In the hydrocele fluid many empty sheaths were found after it had stood in the laboratory forty-eight hours. Manson[35] produced this ecdysis by cooling blood which contained filariæ nearly to the freezing-point. The embryos have remained alive as long as five days in a cover-

slip preparation of the blood kept at room temperature. They seem to undergo a granular degeneration. Henry[36] states that he has kept them alive in a cool room for ten days. In the thermostat at 37.5° C. they usually die in two or three days. When the lashing movements of the body had nearly ceased a peculiar "pouting" movement of the head was observed. Whether this was due to the protrusion of a proboscis or the retraction of a prepuce-like structure, as Manson[37] maintains, we were not able to determine. Attached to the tip of the head is a tiny spine. The pouting movement was found to be repeated twenty-eight to thirty times in a minute.

The structure of the embryos was best studied by fixing ordinary cover-slip preparations of the blood by heat or by a saturated solution of corrosive sublimate, as recommended by Plehn,[38] and staining for a few seconds with Löffler's methylene-blue or with a 2 per cent. solution of thionin. When stained the body is found to be studded with irregular, deeply staining granules. Near the junction of the middle and posterior thirds of the body is an elongated homogeneous structure of wavy outline. Sometimes it is plainly visible in living embryos. Sometimes no trace of it can be seen.

Flint[39] has advocated methylene-blue in the treatment of filariasis, while Laveran and others recommended quinine.

The following experiments were tried with the hydrocele fluid: A drop of hydrocele fluid was mixed with a drop of 1:1000 methylene-blue solution. The filariæ were actively motile after two hours. A drop of quinine sulphate solution, 1:1000, was mixed with a drop of hydrocele fluid. Some filariæ became motionless within a few seconds; all within three minutes. These results agree with those obtained by Laveran.[40]

Neither of our patients was anæmic. The red count in Case I. was about 5,000,000. Lazarus,[41] in his recent work, states that filariasis is the cause of severe anæmia. Doubtless the complications, hæmatochyluria, chylous diarrhœa, etc., may produce this condition, but the filaria embryos *per se* do not appear to impoverish the blood at all.

Clinical Conditions Produced by the Presence of Filaria Nocturna. (The other varieties of filariæ will not be considered in the following pages.)

The presence of filaria embryos in the blood or other fluids of the body is proof of the existence of live parent worms whose habitat is in some portion of the lymphatic system. The duration of life of the parent worm is unknown, hence it has not been determined how long a person may remain a victim of filariasis. Even if the adult worms should die the patient is liable to be reinfected in tropical districts. It is very common for inhabitants of the tropics to harbor the filaria nocturna and yet show no symptoms that would lead one to suspect its presence.

There is no evidence which shows that the parent worms live in other than the lymphatic vessels, or that they migrate from one part of the body to another. The very meagre evidence showing that a subject ever gets rid of the embryos when once infected points to the fact that the parent worms are multiple and abide in different locations. We can find no authentic cases where the embryos have disappeared after the removal of parent worms, which demonstrates that others still remain, although such removal is very frequently followed by complete and permanent relief from all symptoms. Hence, one may be a victim of filariasis and yet not suffer any inconvenience.

So far as known, the embryos do not cause any pathological changes, for their small size enables them to be carried freely throughout the circulatory system.

The parent worms, on the other hand, are capable of producing many different clinical manifestations, consequent, primarily, on obstruction to the lymph circulation. This obstruction is rarely due directly to the worm, but is generally the result of secondary changes which thicken the walls of the lymphatics, and thus narrow their lumen.

Furthermore, the location of the parent worm is frequently the seat of infection, and the presence of an abscess or lymphangitis may be the first warning of any trouble whatever. Manson suggests that the ova are capable of obstructing the smaller lymphatics, and thus he accounts for certain pathological changes.

Hence, the clinical manifestations depend upon lymphatic obstruction, complicated or not by secondary infection.

The symptoms may be:

1. General or constitutional.

2. Local, thus open to wide variations according to the part involved, whether as the result of stasis alone or modified by infective processes.

Constitutional Symptoms. The first warning of the presence of filariæ is often given by the more or less sudden onset of constitutional symptoms before any local signs appear. General debility and fatigue after exertion, and irregular periodical febrile attacks somewhat resembling malaria, are common early symptoms. Pain in the back, pelvis, and groins is frequent, and it may be very acute and accompanied by nausea and vomiting. These attacks are generally relieved by absolute rest, and produced by exertion. Their increasing frequency, together with the appearance of local signs, particularly about the genitals, may be accompanied by severe mental depression, melancholy, and sexual neurasthenia.

When a local area becomes infected with pyogenic organisms the usual constitutional disturbances follow.

In certain mild cases, without local signs, where filariæ have been discovered in the blood, an occasional slight transitory febrile attack

is the only evidence of filarial disease. In other instances the presence of embryos in the blood is the only evidence that apparently perfectly healthy individuals are subject to filariasis.

Local Manifestations. Local signs consequent on the presence of filariæ are subject to great variation according to the part affected. They are due primarily to obstruction of the lymphatic circulation, thus causing injury, and secondarily to the invasion of pyogenic organisms. The changes due to obstruction progress slowly.

Filaria nocturna is known to produce the following local pathological changes:

(1) Dilated lymph glands—varicose glands. (2) Dilated lymph vessels—lymphangiectasis, lymphatic varix. (3) Probable rupture of dilated varices, giving rise to chyluria, chylous hydrocele (chylocele), and rarely chylous ascites and chylous diarrhœa. (4) Cutaneous lymphatic obstruction manifested as œdema—lymph scrotum, lymph vulva, and probably elephantiasis Arabum of the tropics (Manson). (5) Results following pyogenic infection—cutaneous lesions, lymphangitis, cellulitis, abscess. (6) Two or more of these conditions may be associated in the same individual.

1. *Dilated Lymph Glands.* This condition is generally associated with dilated lymph vessels running to and from the glands. The glands of the groin are by far most commonly affected, and either the inguinal, femoral, or both may be involved. It is unusual to observe changes in other lymphatic glands.

They increase slowly, and, as a rule, there are no subjective symptoms to attract the attention of the patient until they have attained considerable size. Then there is a feeling of tension and weight. Unless they are inflamed the skin over them is normal and freely movable. The glands themselves are soft, compressible, doughy, and ill-defined, and not ordinarily tender. They decrease in size when the patient is lying down, and slowly refill when he is erect. The collection of glands may be as large as the fist.

There should be no difficulty in differentiating them from herniæ, varicocele, and varicose saphenous veins. They may be aspirated safely, and the fluid will be yellow, white, or reddish, according to circumstances, and will generally contain embryos. The glands themselves consist of a dilated meshwork containing channels or cavities filled with lymph. Infection with pyogenic organisms gives rise to adenitis and peri-adenitis, which may result in abscess formation.

2. *Dilated Lymph Vessels* (*Lymphangiectasis*). There are occasionally to be seen on the surface of the skin minute lymphatic dilatations. These may suddenly disappear or they may rupture and allow the escape of lymph. The larger lymphatic trunks under the skin are usually associated with dilated lymph glands. The case here reported

would seem to be somewhat unusual, for the glands of the groin were normal, but the lymphatics of the cord were much dilated and thickened, as described above. The lower end of these lymphatic trunks was continuous with the lymphatic dilatations in the testis. In all probability there are points of obstruction in the pelvic lymphatics of this case, which condition alone would seem to account for the dilatation throughout the cord. Clinically the condition resembled that of varicocele.

When infected, a lymphangitis results which is manifested by the usual red streak and indurated cord and the ordinary constitutional reaction. Infection of the cutaneous lymphatics is common in lymph scrotum and elephantiasis.

3. *Rupture of Dilated Varices.* (*a*) Chyluria. This is one of the commonest signs of the presence of filariasis. It may be of sudden onset, and be the first warning of any trouble, or it may be preceded by obscure pains in the lower abdomen and pelvis. Although its appearance is of comparatively sudden origin, it is the result of a chronic process, which has probably existed for months and even years. It is probably the commonest external manifestation of the presence of filariasis, and it is less apt to be associated with other varieties of external changes.

It is probably due to the rupture of dilated varices into some portions of the urinary tract, either the bladder or the kidney. Autopsies on such patients show that the abdominal and pelvic lymphatics may be enormously dilated, thereby obscuring some of the retroperitoneal structures. As a result of such ruptures the contents of the lymphatics is poured into the urinary tract, so that the voided urine contains its normal constituents unaltered in addition to the lymph. The appearance of the urine will vary according to the character of the lymph, but it is generally turbid. It is apt to be milky-white soon after the process of digestion has commenced on account of the excess of fat, but later it is paler on account of the more serous character of the lymph. The urine may become clear suddenly, or remain chylous for weeks and months, then become normal, and remain so permanently, but the chyluria is more apt to recur at some later period. Lanceraux[42] records a case where it persisted fifty years.

In addition to the unaltered normal constituents, the urine contains the products of the lymphatics. It is uniformly turbid when voided, but soon separates into three more or less distinct layers. The great bulk of the urine remains rather uniformly turbid on account of the divided fat globules, but on the surface is a yellowish layer due to larger collections of fat, and on the bottom of the glass are clots of fibrin often discolored with red blood-corpuscles. Hemorrhage is so striking in some cases that the condition is often called hæmatochyluria.

These clots not infrequently form in the bladder and cause temporary obstruction. The urine becomes clarified when shaken with ether. The microscope may show the presence of active embryos.

Although chyluria is the result of a very chronic process, there are certain recognized exciting influences which cause the dilated lymphatics to rupture. Thus chyluria may appear in women after parturition and in men after violent exercise. Like all inaccessible varices, these must be left to take their course.

Chyluria is not directly dangerous to life, but an excessive loss of chyle may cause debility and worry on the part of the patient, may result in mental depression so as to incapacitate him for all sorts of active work. The obscure pains in the back and pelvis are probably due to the overdistended lymphatics.

(*b*) Chylous hydrocele. This complication is the result of obstruction of lymphatics, so that the chyle is poured into the tunica vaginalis testis. In the case which is here reported the "chylocele" appeared for the first time after the primary operation at which the dilated lymphatics of the cord were excised. This prevented the normal return of the lymph from the testis which was provided for by these dilated channels in spite of partial obstruction of the lymph current. The accumulation began at once after these vessels were ligated. The presence of numerous parent worms in the vicinity of the testis was undoubtedly the cause of this excessive escape of lymph, for this operation was practically the one employed in the radical cure of varicocele, which is not often followed by an acute hydrocele.

The physical signs of chylous hydrocele do not differ from those of an ordinary hydrocele. So far as we could determine, the translucency was nearly as pronounced. Knowing what we did in reference to this case, the cause of the fluid accumulation was obvious, but under other circumstances, aspiration and microscopical examination will determine the condition. The character of the fluid in chylous hydrocele has already been described.

The association of a scrotal tumor with varicose lymph glands or other varices should make one suspicious as to its nature. In patients who have visited the tropics any turbid hydrocele fluid should be subjected to microscopical examination in order to determine the diagnosis.

In cases of chylous hydrocele it is probable that parent worms are present in the vicinity of the testis, and on more than one occasion these worms have been recovered from the fluid. Our case demonstrates the value of radical interference. In sixty-two cases of filariasis reported by Manson there were six cases of "chylocele."

These cases may become infected and manifest the usual signs. A lymph scrotum is not an unusual sequence if they are left to take their course.

(*c*) Chylous ascites is probably a frequent complication where the abdominal lymphatics are involved, although there is but little evidence, clinical or pathological, to confirm this statement. The peritoneum would probably absorb the escaped lymph, and no harm result. In the tropics the presence of turbid fluid, which could not otherwise be accounted for, should make the surgeon suspicious as to its character.

(*d*) Chylous diarrhœa is a rare complication.

4. *Cutaneous Lymphatic Obstruction.* (*a*) Lymph scrotum is the result of obstruction in the lymphatics of the integument, and is usually accompanied by other external signs, most commonly by dilated lymph glands. The skin of the scrotum is permanently thickened, but its surface remains intact for a period at least. Vesicles and small varices may appear on the surface, and these may rupture later and allow the escape of lymph. Its color will vary according to circumstances, and the amount may be considerable. Inflammatory changes generally follow, and thus the surface of the scrotum may become eczematous and ulcerated, or cellulitis and abscess may appear in the deeper layers. Thus the scrotum becomes permanently enlarged and resembles true elephantiasis.

(*b*) The changes in lymph vulva are analogous to those in lymph scrotum.

(*c*) Elephantiasis Arabum (tropics).

It is still a disputed question as to whether this condition is a manifestation of filariasis, but Manson offers many convincing arguments in support of this theory. If such is the case, then elephantiasis is the commonest manifestation of the presence of filaria. This question will not be considered here.

5. Results following pyogenic infection: Cutaneous lesions, lymphangitis, cellulitis, abscess.

Many of these conditions have been considered.

It is not unusual, however, for a patient to present himself for treatment on account of an attack of lymphangitis or abscess, more particularly on the extremities. There is often the history of a trauma.

Adult worms have been found in these lymphatic abscesses, after the removal of which local recovery follows, but in no case, so far as we can learn, have the embryos permanently disappeared from the blood, showing that parent worms have always existed elsewhere.

Ordinarily a dead worm probably becomes encysted, as demonstrated in our case; but if infection should take place, lymphangitis or abscess is the usual course, and the dead worm may be discovered in the pus. These local signs of infection may be the only external evidence of anything wrong with the patient, but an examination of the blood may reveal the presence of the embryos.

6. That two or more of the above conditions may be associated in

the same individual, accompanied or not by secondary inflammatory changes, need not further be discussed.

Course and Prognosis. Cases of spontaneous recovery are recorded. There are no recorded cases, so far as we know, where operation has been followed by the permanent absence of embryos, although it is common for such patients to be permanently relieved of further objective and subjective symptoms. The length of life common to the parent worm has not been established, but if the patients should not be exposed to later invasion, in all probability the parent worms would die in time, and no further embryos appear. Much of the damage, however, sustained by the lymphatics can never be repaired. Most of the cases which have been studied thus far have continued to dwell in the tropics and are thus exposed to secondary invasion.

In many cases the parent worms reside in inaccessible lymphatics, and, therefore, cannot be reached, and the case must be left to take its course. In other instances the parent worms are accessible to the surgeon, and their removal is often followed by great benefit and sometimes apparent recovery, as in our case, although a few embryos still exist, showing that he still harbors more parental forms. In all probability the number of embryos present is a fair guide as to the number of parent females. The embryos may be too few to be detected by casual examination. Many subjects of filariasis escape without any symptoms, and the embryos themselves do no harm so far as is known.

Filariasis, when due to the filaria nocturna, runs a chronic course and is not a direct danger to life. Fatal issues have generally followed some intercurrent infection.

Certain local manifestations can be permanently relieved by surgical measures.

Prophylaxis. Filariasis cannot be transmitted directly from one person to another, for the embryos require an intermediary host before they can develop into adult worms. It seems to have been demonstrated beyond question that certain species of mosquito act as this host, and that the young filariæ continue their existence in water, and are thus taken into the system.

In filarial districts all sources of drinking water should be protected from mosquitoes. Cisterns and wells should be kept covered. The only safe precaution is that all drinking-water should be either filtered or boiled, and at some future time the filtration of the municipal water-supply may be demanded. Reservoirs should be cleaned often and regularly. It is never safe in such districts to drink from open streams and pools.

Our patient states that it is customary for the white population of Barbadoes to drink only filtered water, but that he and his brother were in the habit of drinking from any pool while on hunting trips.

In a moderate degree subjects of filariasis are a danger to a community.

TREATMENT. Where the presence of embryos alone is the only sign of filariasis no treatment is necessarily called for in order to relieve any symptoms, but, furthermore, there is no known method whereby such embryos may be removed. On the other hand, the embryos *per se* are harmless so far as is known. All treatment, therefore, to be of any permanent value, must be directed toward removal of as many of the parent worms as possible. In that the lymphatics most commonly involved (pelvic and abdominal) are not readily accessible, and the exact location of the parasites is difficult to determine, these cases are best treated by allowing them to take their course; but if secondary complications follow, then surgical measures may be of great service.

MEDICINAL TREATMENT. There are at present no known drugs, when administered to the patient, which have proved to be of value in killing the adult worms. It is the custom in filarial districts to administer large doses of quinine. Although weak solutions of this drug will kill the embryos outside of the body, its administration seems to have no effect on them in the circulation, and their persistence shows that it is not capable of killing the adults. Its use, however, is probably of value in counteracting some of the secondary constitutional symptoms.

It is not improbable that local injections of certain antiseptics might serve to kill the parent worms if they could be located. Even then only certain regions would be accessible to such treatment.

OPERATIVE TREATMENT. As a general rule, operative treatment is of value only in relieving certain local conditions. If the site of such local condition should happen to be accessible to the surgeon, and to be the only nidus of adult worms, then operation might be curative; but, unfortunately, this must be a rare circumstance. These facts do not contraindicate operation.

The immediate indication for operation is generally some local result of lymphatic obstruction, complicated or not by secondary infection. During the dissection of these wounds there may be considerable escape of lymph, so that it is wise to ligate all lymphatic vessels carefully. The oozing of lymph can otherwise be controlled by packing and pressure. Such wounds generally heal in the ordinary manner. Local recurrences are unusual.

TREATMENT OF AND OPERATIONS FOR SPECIAL COMPLICATIONS.

1. *Dilated Lymph Glands.* These glands are usually part of a large varix, and if they are small and do not cause any inconvenience, it is wise not to interfere. If they are large enough to cause discomfort, or if they are the seat of recurring inflammatory processes, it is advisable to excise them.

Such excisions have been followed by chyluria and elephantiasis of the leg, but this does not necessarily prove that these are direct results.

2. *Lymphangiectasis.* Dilated lymph varices are usually associated with other neighboring complications and should be treated simultaneously. Dissection should be as complete as possible and both ends of large vessels ligated.

3. *Chyluria* is considered to be the result of rupture of varices which are practically inaccessible, so that such cases are not suitable for operation. The patient should be put to bed and the hips elevated in order to reduce the hydrostatic pressure. The diet should be restricted, and the fat elements withheld so far as possible. Cathartics and diuretics are valuable in order to relieve the tension in the lymphatics, and thus allow the rupture to close. Otherwise the case must be left to take its course.

4. *Chylous Hydrocele* is simply a collection of lymph in the tunica vaginalis testis. In our case many parent worms were lodged in the testis, and at the same time the lymphatics of the cords were much distended, and thus extended into the abdominal cavity, showing that pelvic obstruction must exist.

In such a case simple incision or the injection of irritants would not cure a hydrocele, nor would it be practicable to attempt to dissect out adult worms from the lymphatics about the testis. Operation must be radical, and it would seem to be wisest to excise the testis and the cord as high as possible. In this case the local cure was prompt, uncomplicated, and thus far it has remained permanent.

The rare complication of chylous diarrhœa should be treated by rest and on general principles.

Chylous ascites would probably be recognized only in the course of a cœliotomy for some intercurrent cause.

5. *Lymph Scrotum.* The scrotum should be kept scrupulously clean and dry; it should be powdered, protected, and suspended. By this means infection may be avoided for a time. When its size makes it troublesome, or if it is the seat of recurring attacks of inflammation, then it should be excised. Margins of healthy skin should be left and the testicles need not be sacrificed. Flaps of skin may be obtained from the thighs, if necessary, to cover in the wound.

6. *Elephantiasis* is a condition which is permanent and tends to increase. Ninety-five per cent. of the cases involve the leg. In the early stages the process may be retarded by the use of elastic bandages, careful massage, and resting the part as much as possible. Its progress is usually slow unless the surface becomes excoriated and infected, when secondary symptoms and changes set in. In the tropics the part should be protected from the hot sun, and the leg should be kept dry. Occasionally excision of strips of skin may be of palliative value, but at times the condition of the leg may be such that only amputation will

give relief Most cases of elephantiasis are troublesome on account of the secondary inflammatory processes.

Elephantiasis of the scrotum may follow a lymph scrotum and reach enormous dimensions. Removal by operation is the only method of relief, and this may be performed with comparative safety.

Elephantiasis elsewhere has been rarely subjected to surgical intervention.

7. *Infective Complications Associated with Local Filarial Lesions.* These complications are very common and may be manifested as erysipelas, lymphangitis, cellulitis, and abscess. Constitutional symptoms, often severe, are present at one time or another. The ordinary methods of treating infected wounds should be made use of according to circumstances. After the acute process has subsided the various local lesions may be treated in a radical manner as described above.

Comparatively few operations have been performed for filarial processes, and most of these have been carried out in the tropics, notably at the Madras Hospital, India, where many of the results have been excellent.

We take this opportunity of expressing our thanks to Dr. Councilman and to Dr. Mallory for advice and assistance; to Messrs. Brinckerhoff and Richardson, of the Harvard Medical School, for the excellent photographs, and to Miss Jones and Dr. Howe for the drawings.

References.

1. Dermarquay. Note sur une Tumeur des Bourses contenant un Liquide Laiteux (Galactocèle de Vidal) et renfermant des Petits êtres vermiformes que l'on peut considérer comme des helminthes hématoïdes à l'état d'embryon. Gaz. méd. de Paris, 1863, xviii. 665.

2. Wucherer. Notica preliminar sobre vermes de uma especie ainda nao descripta encontrados na urina de doentes de hematuria intertropical no Brazil. Gazeta Medica da Bahia, December 15, 1868, p. 97.

3. Salisbury. On the Parasitic Forms Developed in Parent Epithelial Cells of the Urinary and Genital Organs and in their Secretion. Amer. Journ. Med. Sci., 1868, lv. 371.

4. Lewis. On a Hæmatozoön in Human Blood. Reprint from Indian Annals of Medical Science, Calcutta, 1874.

5. Cobbold. On the Discovery of the Intermediary Host of Fil. Sang. Hom. Lancet, 1878, i. p. 69.

6. Lewis. The Nematoid Hæmatozoa of Man. Quart. Journ. Microsc. Soc., 1879, 245. The original article, which appeared in the Proc. Asiatic Society of Bengal, Calcutta, 1878, was not accessible to the writers. It is abstracted by Nuttall, Johns Hopkins Hospital Reports, 1899, viii. 65.

7. Low. A Recent Observation on Filaria Nocturna in Culex: Probable Mode of Infection of Man. British Medical Journal, 1900, i. 1456.

8. Manson. The Life-history of the Malarial Germ Outside the Human Body. (Goulstonian Lectures.) Lancet, 1896, i. 831.

9. Manson. Lymph Scrotum, Showing Filaria in Situ. Trans. Path. Soc., London, 1881, xxxii. 285.

10. Mackenzie. A Case of Filarial Hæmatochyluria. Trans. Path. Soc., London, 1882, xxxiii. 394.

11. Manson. On Filarial Periodicity. Brit. Med. Journ., 1899, ii. 644.

12. Manson. Tropical Diseases. London, 1898, 447.

13. Manson. Fil. Sang. Hom., Major and Minor. Two New Species of Hæmatozoa. Lancet, 1891, i. 4.

14. Daniels. Discovery of the Parental Form of a British Guiana Blood Worm. Brit. Med. Journ., 1898, i. 1011.

15. Cobbold. Discovery of the Adult Representative of Microscopic Filariæ. Lancet, 1877, ii. p. 70.
16. Thorpe. Fil. Sang. Hom. in the South Sea Islands. Brit. Med. Journ., 1896. p. 922.
17. Strube. Ueber das endemische Vorkommen von Parasiteneiern und Larven im Harn der Bewohner von Natal und Transvaal. Deutsch. med. Woch., 1897, No. 33, p. 522.
18. Guitéras. The Fil. Sang. Hom. in the United States. Chyluria. Med. News, 1886, xlviii. 399.
19. de Saussure. A Clinical History of Twenty-two Cases of Fil. Sang. Hom. Med. News, 1890, lvi. 704.
20. Mastin. The History of the Fil. Sang. Hom., its Discovery in the United States, and especially the Relationship of the Parasite to the Chylocele of the Tunica Vaginalis Testis. Annals of Surgery, 1888, viii. p. 321.
21. Slaughter. Two New Cases of Fil. Sang. Hom. Med. News, 1891, ii. 649.
22. Dunn. A Case of Fil. Sang. Hom. Trans. of the College of Phys. of Phila., 1898, p. 80.
23. Cobbold. On Filaria Bancrofti. Lancet, 1877, ii. 495.
24. Lewis. Fil. Sang. Hom. (Mature Form) Found in a Blood-clot in Nævoid Elephantiasis of the Scrotum. Lancet, 1877, ii. 453.
25. dos Santos. Filaria Bancrofti. Verificaçao no Brazil da descoberta de Bancroft, na Australia. O Progresso Medico, 1877, ii. 95.
26. Sibthorpe. On the Adult Male Fil. Sang. Hom. Brit. Med. Journ., 1889, i. 1344.
27. Maitland and Manson. A Case of "Filarial Disease" of the Lymphatics in which a Number of Adult Filariæ were Removed from the Arm. Brit. Med. Journ., 1894, i. 844.
28. Huber. Animal Parasites. Twentieth Century Practice of Medicine, 1896, viii. 605.
29. Young. Filariasis; Lymph Scrotum and Varicose Groin Glands, Brit. Med. Journ., 1897, i. 1037.
30. Magalhaes. Filarias encontradas no coraçao humano. Rio de Janeiro, 1886. Abstracted by v. Linstow, Cent. f. Bakt., 1892, xii. 88; vide also London Med. Rec., 1887, xv. 273.
31. Bourne. A Note on Fil. Sang. Hom., with Description of a Male Specimen. Brit. Med. Journ., 1888, i. 1050.
32. Soboroff. Untersuchungen über die Bau normaler und ectatischer Venen. Virchow's Archiv, 1872, liv. 306.
33. Janni. Die feinen Veränderungen der Venenhäute bei Varicen. Arch. f. klin. Chir., 1900, lxi. 12.
34. Marie. Adenolymphocèle inguino-crurale d'origine filarienne; examen histologique. Bull. de mém. Soc. de chir. de Par., 1898, xxiv. 807.
35. Manson. On the Production of Artificial Ecdysis in the Fil. Sang. Hom. Noct., etc. Brit. Med. Journ., 1893, i. 792.
36. Henry. Report of a Case of Indigenous Parasitic Chyluria, with Filaria Nocturna in the Blood. Med. News, 1896, lxviii. 477.
37. Manson. The Fil. Sang. Hom. and Fil. Diurna. International Clinics, April, 1895, p. 66.
38. Plehn. Die Kamerun-Küste. Berlin, 1898, 300.
39. Flint. A Case of Fil. Sang. Hom. with Chyluria Treated Successfully with Methylene-blue. New York Med. Journ., 1895, lxi. 737.
40. Laveran. Sur un cas de filariose. Bull. et Mémoires de la Soc. Méd. des hôpitaux de Paris, 1893, x. 738.
41. Lazarus. Die Anaemie. II Abtheil., Vienna, 1900, p. 63.
42. Lanceraux. Un cas de filaire hématique chez l'homme. Gaz. des hôpitaux, 1888, lxi. 630.

RECURRENT VOMITING IN CHILDREN. (CYCLIC VOMITING.)[1]

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The following case-histories illustrate a condition which seems well worthy of a more extended consideration than has been devoted to it hitherto. The first case is an instance of the disease in a mild form and,

[1] Read at the meeting of the Association of American Physicians, Washington, D. C., May, 1900.

in a way, on the border line. The second is one of unusual severity, and shows how severe the disease may become. The third and fourth go still further, since both the children died.

CASE I.—Marcellus H., born January 5, 1895. In infancy his digestion was feeble and vomiting occurred frequently. After July, 1895, his general health suffered through failing appetite and increasing indigestion. The latter was frequently present in the winter of 1895–96. Later health and digestive power improved. There was irregular fever during most of the summer of 1896, and again in the summer of 1897, when he was under my care, and to less extent in that of 1898. The fever seemed to be the result of chronic auto-intoxication of intestinal origin, although there were few evidences of indigestion, and vomiting was unusual.

Up to this period in his life the occasional vomiting had been apparently clearly the result of acute indigestion. Now, however, he began to have certain severe attacks of vomiting of the type presently to be described, which seemed entirely unassociated with any indiscretion in diet or symptoms of indigestion. These attacks occurred about every three or three and a half weeks, and continued to appear until early in the spring of 1899, when he again came under my care. I saw him in March, 1899, at the beginning of one. Since this time he has had but one slight attack. The nature of an attack was much as follows: The child would be apparently well and lively for some weeks. Then, without discoverable cause, or any decided symptoms of indigestion, he would lose his appetite for a few days and become constipated. High fever then developed, and vomiting soon began. The latter lasted during one or two days, and occurred frequently, especially if anything was put into the stomach. Fever abated after vomiting commenced. There were decided prostration, restlessness, rapid respiration, much thirst, and retracted abdomen. Complete loss of appetite continued. Loss of flesh was rapid. Constipation was present during the attack, but could be overcome by purgatives, although with some difficulty. Its relief was sometimes accompanied by relief of the vomiting; but in other attacks, where no purgatives or enemata were given, vomiting ceased before the bowels were opened. There was, in fact, no clear connection between the relief of the constipation and the cessation of the vomiting. The urine was sometimes diminished in amount before the attack, and during it it remained scanty. The urine obtained on March 18th, at the beginning of convalescence, contained a large deposit of crystals of uric acid. Analysis made by Prof. John Marshall, of the University of Pennsylvania, gave a ratio of uric acid to urea of 1:116. A specimen passed on May 26th, at a time when the child was in excellent health, still showed a diminished excretion of uric acid. Convalescence from the attacks was rapid. The early evacuation of the bowels, an almost total withdrawal of food, and the administration of small doses of a bromide salt with a febrifuge appeared to abbreviate the attacks.

CASE II.—Henry A., born May 12, 1891. He had always been a nervous, but otherwise healthy child. His first attack of recurrent vomiting took place in July, 1894; the next two in January and in December, 1895. These earlier seizures lasted about one day, not often longer. Constipation was not noticed, if present. The vomiting was

severe, but not alarming; it was not connected in any way with the diet or attended by indigestion. There was always restlessness, sighing respiration, and tonsillitis. Recovery was rapid unless tonsillitis had been severe. The first truly alarming attack, which was nearly fatal, took place in March, 1897. He had mild seizures in January, 1898, and in May, 1898. A second severe attack occurred in July, 1898. There has been no recurrence.

The two severe attacks must be described somewhat in detail. The first commenced about March 31st with severe vomiting. Very soon this symptom became grave. It was almost continuous, everything which went into the stomach being promptly ejected, and efforts at vomiting occurring frequently, even though nothing was taken. The bowels had been obstinately constipated, in spite of purgatives and of large enemata frequently given, and the attending physician feared intestinal obstruction. I saw the boy late on April 2d. On this date for the first time a bowel movement had been obtained, yet without relief of the gastric condition. Prostration was extreme; there was great restlessness and also much thirst. The respiration was accelerated and sighing, especially when he was asleep. The child slept only fitfully and after an attack of vomiting, soon rousing, tossing, and suffering another attack. There was no pain, tenderness, or retraction of the abdomen. The secretion of urine was diminished. All treatment had been unavailing, including the administration of chloral and bromides by the bowel, and the prognosis seemed most grave. I advised the giving of morphine by hypodermatic injection.

I learned the following details later: The morphine was not given. Vomiting continued, and the exhaustion increased until finally the child lay helpless on his sde, while every few moments a little dark or blood-stained fluid ran from his mouth, forceful vomiting being no longer possible. Constipation was now absolute. Another consultant was called, and various drugs were administered, but without benefit. At last, after several more days had elapsed, with the death of the child apparently certain and not far distant, the attending physician in desperation began narcotizing him with morphine in the way suggested. The good effect was immediate, the vomiting ceasing at once and permanently. Within twenty-four hours the bowels were opened by enema, and an uneventful convalescence was established.

In the attack of June, 1898, the child had been ill for one or two days before I saw him. Very little urine had been voided, and constipation had been absolute. There was no great prostration. The attending physician had wisely refrained entirely from feeding by the mouth, and the bowel had been used for nutrient enemata only, without any effort to produce a stool. Apparently as a result of this conservative treatment the vomiting was already better when I arrived. There had been no abdominal pain, tenderness, or retraction. I continued nutrient enemata, and gave Rochelle salts in small repeated doses by the mouth. Vomiting did not recur, and in about twelve hours sighing respiration and restlessness ceased, the bowels were freely opened, and appetite returned. Convalescence was rapid.

The vomited matter in this case was never especially sour. There was never any peculiar odor to the breath. The urine was generally and sometimes greatly diminished before an attack. This scanty secretion continued during the attack. No albumin was found at any time.

The parents, who are most intelligent and observing, could never trace any connection between evacuation of the bowels by purgatives or enemata and cessation of the vomiting. On the other hand, they have found that the chief or only premonitory symptoms were a congestion of the head and a scanty urination; and they have thought that a threatened attack could be prevented by prompt drainage of the system through the bowel, the flushing of the kidneys by large draughts of water, and withdrawal of all food except milk.

For the notes of the following case I am largely indebted to Dr. Alexander Marcy, Jr., the attending physician. I saw the boy in one of the attacks occurring in the spring of 1896.

Case III.—A. H., born August, 1891. He was a healthy child until the age of nearly two years, except for the occurrence of gastro-enteritis with meningitic symptoms at fourteen months. In June, 1893, he had his first attack of recurrent vomiting, which lasted only a few days, and was supposed to be ordinary indigestion. A second severer attack occurred in February, 1894, another slight one in July, 1894, a quite severe one in February, 1896, two seizures in March, 1896, in May a desperate one, which lasted eight days, and in July, 1896, one which lasted ten days, in which his life was despaired of. The final attack occurred in October, 1896, lasted but two days, and terminated fatally.

The symptoms in all the attacks but the last were much the same. After some loss of appetite, coating of tongue and malaise during the day, vomiting came on suddenly, generally at night. This soon became obstinate and occurred every few minutes, the vomited matter being at first the ingested food, and later mucus and bile, sometimes with streaks of blood. There was great restlessness, continued tossing, and but little sleep. The pulse grew rapid and weak, and respiration irregular and sighing. The temperature was always elevated on the first day. After this it sometimes fell below normal, to rise to fever heat later; sometimes it continued elevated throughout the attack. Normal stools occurred at first, either spontaneously or by enema. Later, after twenty-four to forty-eight hours, the bowels were obstinately constipated, and peristalsis seemed to be arrested. When the attack was over the bowels would move of themselves. Slight abdominal pain was always present Thirst was intense. The breath had often a peculiar odor. The urine was apparently increased in amount at first, acid, and of high specific gravity, but after one or two days it became scanty, and later even almost suppressed. Indican was present in considerable quantities at first; later acetone appeared. Albumin was absent. Exhaustion finally became extreme, the eyes sunken, and the whole body shrunken, dry, and cold. The mind was always unaffected. Gradually the vomiting became less frequent, restlessness diminished, and recovery began and advanced, usually with rapidity, but slowly after the severest attacks. During convalescence there was often considerable general pruritus.

The last attack differed somewhat from the others. Vomiting was less frequent, but unusually violent, and in a few hours the child was vomiting blood. After twenty-four hours the urine contained albumin, casts, and blood. Death followed from cardiac failure.

Hypodermatic injections of morphine or the administration of chloral and bromides appeared to be of slight service in some attacks, but generally were of no avail.

The following case likewise occurred in the practice of Dr. Marcy. I saw the child in one of the attacks and on a number of other occasions, both when well and when seizures seemed to be threatening.

CASE IV.—Honoria H., born March 2, 1892. She had been a healthy child up to the age of about three years, when she began to have attacks of vomiting, which developed suddenly, were attended by fever, lasted a short time, and were supposed to be due to indigestion. In September, 1895, she had a much worse seizure, which lasted a week. Exhaustion at this time was so great that recovery was despaired of. The next occurred in July, 1897, and another in August, 1897, this being the worst yet experienced, and lasting eight days, during most of which time death was momentarily expected. I saw her for the first time on October 1, 1897, when she was apparently well. After this, during the early part of October, she appeared often to be on the brink of an attack, but none occurred, and the child's general health became good until February 21, 1898. On this date, after about a week of premonitory symptoms, vomiting began, and continued nearly constantly for twenty-four hours. It then lessened somewhat, but soon returned in force. I saw her about the 26th, and found her exhausted and with vomiting still very frequent, although apparently lessening. A few days later she was seen by a prominent surgeon of Philadelphia, who inclined to the diagnosis of appendicitis, but believed that operation was not justifiable, as recovery seemed impossible. She did, however, recover. About a week after convalescence she suffered for a time from diffuse severe articular pains, later changing into mere stiffness, but unattended at any time by swelling of the joints. She was later, when in good health, re-examined by the surgeon, who diagnosed chronic appendicitis, and urged operation. The appendix was removed in April, 1898. Macroscopical examination showed no material change. Microscopically there were slight evidences of inflammatory alterations. After the operation improvement in health continued and was ascribed in part or wholly to the removal of the appendix; but in March, 1899, she had another attack of vomiting, worse than any previous one, and she died exhausted after an illness of nine days.

Autopsy showed necrotic changes in the mucous membrane of the stomach and intestines, slight parenchymatous alterations in the pancreas, spleen, and kidneys, and fatty infiltration of the liver.

The symptoms in this case were in most respects identical with those described in Case III. There were the same uncontrollable, frequent vomiting, loss of appetite, restlessness, sighing respiration, rapid pulse, and inconsiderable abdominal pain and tenderness. The secretion of urine was affected in the same manner, indican and acetone being present as in that case. In contrast, however, although the onset was sudden in some attacks, in others the prodromal symptoms lasted longer, coated tongue, loss of appetite, and restlessness continuing for several days. Pruritus during the attack was more marked. Toward the end of the fatal attack albumin and casts appeared in the urine.

Repeated examinations of the urine were made for me by Prof. John

Marshall, but the results were only partially satisfactory, owing to unavoidable circumstances. Examination on October 16, 1897, when the child exhibited what appeared to be prodromal symptoms, but which, however, did not advance further, showed neither indican nor acetone. On December 2, 1897, the child being at this time in good general health, the uric acid urea ratio equalled 1 : 113. No indican or acetone was present. On February 22d, the second day of an attack, the uric acid urea ratio was 1 : 176. Acetone and indican were present.

In the way of treatment, morphine hypodermatically or the giving of the bromides and chloral seemed at times to do some good.

Very little that is definite appears in medical literature concerning this curious disease, although in my reading I have doubtless overlooked much. The Paris thesis by Solelis was not accessible to me. Most writers refer to the article by Leyden[1] as the first upon the subject. This author discusses certain gastric crises under the title of "periodical vomiting," which condition he regards as a pure neurosis, the symptoms of which are practicaly identical in every way with those of the gastric crises of tabes. In the cases he described there were present great abdominal pain, frequent and very profuse vomiting, constipation, scanty urine, retracted abdomen, great exhaustion, and no fever. The abdominal pain was a very prominent symptom, and was sometimes associated with other neuralgias. There was no regularity in the intervals between the attacks. All the cases detailed occurred in adults. Myerhoff[2] describes in detail a similar case in a woman, in which abdominal tenderness and severe pain always attended the vomiting. Meisl[3] reports cases very similar to those of Leyden. He states, however, that there was no pain except during the act of vomiting, and he insists on the regularity of the recurrence of the seizures. This regularity, at variance with Leyden's experience, is also insisted on by Einhorn[4] in an article on the subject. Rémond[5] collected from medical literature and from his own experience cases of periodical vomiting. In all of these intense pain was the most prominent feature. All were in adults.

There are a few other writers referring to the condition described by Leyden, but nearly all of them dwell upon the element of marked abdominal pain as almost or quite pathognomonic, and compare the attacks to the gastric crises of tabes. The condition appears to be an undoubted neurosis, which, although allied to, is yet different in some important respects from that which my own cases illustrate, about the purely neurotic nature of which there is some doubt. The difference in the amount of pain is one great characteristic. This view is held,

[1] Zeitschrift für klinische Medicin, 1882, iv., 605.
[2] Deutsche medicinische Wochenschrift, 1881, vii., 710.
[3] Centralblatt f. d. gesammte Therapie, 1897, xv., 459.
[4] Twentieth Century Practice of Medicine, vii., 343.
[5] Arch. gén. de Méd., 1889, clxiv., 38.

too, by Boas,[1] who, in describing a series of cases of gastric neuroses, draws a sharp distinction between gastric crises and periodical vomiting, basing this on the marked element of pain and the presence of an excess of HCl in the secretion in the former, and the slight development or absence of pain and the absence of an excess of HCl in the latter. He agrees, however, with those who insist upon regularity in the periodicity of the attacks of vomiting. The cases of all the writers mentioned occurred in adults.

We have next to consider another condition described in medical literature, which also appears to differ from that now under consideration. Langford Symes[2] writes of what he denominates "gastric attacks." These occur in children only. There develop suddenly profound nervous disturbances, and the child seems alarmingly ill. There are constipation, vomiting, and even collapse. But the affection always depends on definite demonstrable dietetic causes, and the vomiting often relieves the attack. W. Soltau Fenwick[3] describes under the title of "Recurrent Gastric Catarrh" a condition which, he states, is identical with "periodic" or "cyclic" vomiting. He claims that it is extremely common, generally mild, and depends upon a catarrhal state of the stomach. All this is at variance with the experience of other clinicians; and we are forced to the conclusion that the great majority of the cases on which his views are based do not belong to the category now under consideration.

A number of writers have described the disease as my own cases represent it. Gee[4] details nine cases of what he denominates "fitful" or "recurrent" vomiting, of which probably five certainly belong to the disease now being discussed. Pepper[5] contributes a valuable article upon the subject, although without details of cases. Snow[6] gives the details of a case in a girl, aged eight years, which must certainly be classified with my own. In the discussion of this paper Seibert, Caillé, and Forchheimer reported having seen cases in children. Rotch[7] gives a clear description, with the details of three cases of eight months, twenty-two months, and nine years respectively. Rachford[8] describes three cases seen by him which are clearly instances of this disorder. The ages were eighteen months, two years, and four years. He makes some important suggestions regarding the pathology of the affection. Holt[9] contributes a valuable chapter upon the disease, with the report

[1] Deutsche medicinische Wochenschrift, 1889, xv., 864.
[2] Dublin Journal of the Medical Sciences, 1897, civ., 112.
[3] Disorders of Digestion in Infancy and Childhood, 1897, 233.
[4] St. Bartholomew's Hospital Reports, 1882, xviii., 1.
[5] Cyclopædia of the Diseases of Children (Keating), iii., 22; also supplemental volume, 631.
[6] Transactions of the American Pediatric Society, 1893, v., 185. [7] Pediatrics, 841.
[8] American Text-book of the Diseases of Children, second edition, 96; Archives of Pediatrics, 1898, xv., 605.
[9] Diseases of Infancy and Childhood, 287.

of a case in a child of six years, and discusses the relationship of the affection to certain urinary changes. Whitney[1] describes a very typical case in a girl, aged eight and a half years. Marcy[2] gives a graphic description of the affection in three cases, two of which are included in my own report, since they were likewise more or less under my own care. The other case occurred in a girl of six years.

Fuller details of the cases of these writers will be given in the analysis which follows.

Symptomatology. The four cases which I have observed have a striking likeness to each other, although differing in certain particulars. The first was a mild case, resembling in some respects the condition described by Symes, yet differing in the absence of any discoverable dietetic or other cause. The second case was one of unusual severity; the third and fourth cases were fatal. Comparing them with the last group of cases to which I have referred as found in literature, we observe a complex of symptoms which is eminently striking and characteristic, and which must be studied more in detail. These symptoms appear in separate attacks, which develop with more or less suddenness, and which are separated by more or less irregular intervals, during which time the child is, as a rule, in excellent health.

Prodromal symptoms of an attack may be absent, and the child begin to vomit without any evidence of previous illness. In other cases there are prodromes, but these are generally insignificant and indefinite, consisting of malaise, some coating of the tongue, loss of appetite, possibly headache, and some disturbance of the bowels, generally constipation, sometimes slight diarrhœa. These last but a few hours to a day, rarely longer. In one of my cases (IV.) prodromes lasted a week, and a furred tongue continuing a week was seen in one of Gee's cases. There is, however, never any distinct evidence or history of decided indigestion preceding or in any way connected with the outbreak of an attack.

Vomiting is the first and most striking symptom of the attack itself. From the outset it is obstinate and oft-repeated. At first the contents of the stomach are ejected, not, as a rule, showing any evidence of abnormal fermentation. Later the vomited matter consists of watery fluid, with mucus or bile, and sometimes with blood. Sometimes there is also violent unproductive retching. Generally everything put into the stomach is promptly vomited. Snow found that in his case the vomited matter contained an excess of HCl, but other writers have not corroborated this. Further investigation is needed on this point. The vomiting may sometimes cease temporarily and then recommence. Generally it continues very frequent until toward the close of the attack, and then gradually or suddenly ceases.

[1] Archives of Pediatrics, 1898, xv., 839. [2] International Clinics, ninth series, iii.

Constipation is a very constant but not necessary symptom. It is sometimes so obstinate that no treatment has any effect whatever, the action of the bowel seeming to be paralyzed. In some cases, however, as, for instance, in that of Snow, it can be readily relieved, although the vomiting continues. In Whitney's case the bowels were slightly loose and offensive. In two of Gee's cases the bowels were not affected, except that in one they were sometimes whitish in color. In three of my own cases, although there were sometimes a few loose movements at the first, obstinate constipation soon became a very prominent feature. In no case reported does it appear, however, that relief of the constipation had any influence in bringing the vomiting to a close. Rather the bowels appeared to act because the attack was nearly over. This is also the opinion expressed by Leyden regarding the cases of periodical vomiting reported by him.

The *appearance of the abdomen* does not seem to be uniform. Retraction or flatness is probably common. It is referred to by several writers, and was present in at least two of my own cases. It does not appear to be any greater, however, than would occur in any asthenic state with empty intestines. This is in marked contrast to the periodical vomiting of Leyden. Distention of the abdomen by gas does not seem to occur.

Abdominal pain is a symptom almost entirely absent in the cases which appear to belong strictly to this category. As has been already pointed out, this is in sharp contradistinction to the very marked pain which characterizes both the gastric crises of tabes and the similar idiopathic gastric crises which the cases of Leyden and several other writers quoted represent. There is sometimes slight pain and tenderness during the attack, but no more than the fatigue of the muscles by the constant vomiting can well account for. This absence of severe pain seems to be the common experience of observers of recurrent vomiting in children. Only in one of Gee's cases could pain be called decided.

Thirst is commonly intense, due doubtless to the abstraction of liquid from the system and the inability to retain any ingested.

Appetite is generally completely lost. The *tongue* is variable. It is not, as a rule, as greatly coated as in cases of indigestion. Rotch refers to this fact as of diagnostic importance. The tongue was dry in Holt's case, and slightly coated in Snow's and Whitney's cases. In two of my own cases (III. and IV.) it was at first slightly coated, and later more so. Case I. also exhibited a coated tongue. I have no record of its condition in Case II. The *breath* is described as of a sickening odor by Rachford, while in two of my cases, Dr. Marcy, who was in attendance, noticed a very peculiar odor (acetone?). In the other two cases nothing characteristic was observed. Other writers do not refer to the matter. *Sore-throat* always attended in one of Gee's cases; tonsillitis

occurred in one of the attacks in Snow's cases and in some of the earlier attacks in one of my own (II.).

There appears to be no rule about the *temperature*. Rotch describes it as normal or subnormal in his cases. In the case reported by Holt it was elevated at the beginning, and later subfebrile or normal. In Whitney's case there was slight fever. In Snow's the temperature ranged from 100° to 105° F. In Seibert's case there was fever, as there was also in Rachford's cases and in some of Gee's. In my own experience there was decided fever in Cases I., III., and IV.; no record in Case II. It would appear, then, that in recurrent vomiting there is apt to be more or less fever during the attack, although this is not a necessary symptom.

Respiration is decidedly affected. In my second and third cases it was peculiarly sighing; in the fourth case irregular, and in the first case rapid. In Rachford's cases it was rapid, and often very greatly so as the exhaustion increased. The *pulse* generally becomes rapid. Often it is slightly irregular. The only exception I have noted to this opinion is the statement of Rotch, that the pulse is sometimes slow.

The condition of the *urine* is of great interest, but as yet no conclusions can be drawn regarding it. Rachford describes the urine as scanty during the attack, and in one case containing albumin and casts, which disappeared at once when the attack was over. The only case carefully studied with regard to the amounts of urea and uric acid present has been that of Holt. In this the ratio of uric acid to urea before the attack was 1 : 54; during the attack, 1 : 157 and 1 : 132; during convalescence, 1 : 50. In my own cases circumstances prevented the more extended and exact study of the urine which might have thrown light upon the pathology of the disease. In Case I. the secretion of urine was sometimes increased as a prodromal symptom, but scanty during the attack. The analysis during convalescence, made for me by Professor John Marshall, showed a ratio of uric acid to urea of 1 : 116. It must be stated, however, that some trace of the symptoms was still remaining. In Case II. the amount of urine was generally diminished, and sometimes greatly so, during the prodromal period and in the attack itself. During convalescence urine was passed freely. In Case III. urine was increased in amount just before the attack, and contained indican. Later it was diminished and acetone was present. In the last attack it contained albumin and casts. In Case IV. exactly the same condition was observed as in Case III. Beside this, an examination for uric acid and urea at a time when the child seemed in good health gave a ratio of 1 : 113. Another examination made on the second day of an attack gave a ratio of 1 : 176. The observations on the uric acid urea ratio in my own cases are, therefore, not conclusive.

The *nervous and general symptoms* are interesting. In Snow's case convulsions commonly occurred in the earlier attacks, but were absent in later ones. I find no other instance of this symptom recorded. Extreme restlessness with constant tossing and the occurrence of very little sleep were noticed in two of my cases (III. and IV.). The presence of restlessness was observed by Rotch in one of his cases. Later in the disease exhaustion becomes extreme, emaciation is marked, and the child lies apathetic, although generally entirely conscious. In bad cases a state of collapse is present, from which it may seem impossible that the patient can rally. Itching of the skin was present in two of my cases.

The *duration* of the attacks is variable. Recovery is generally rapid. In Holt's detailed case the attack lasted always five days, although improvement began on the third day. In Whitney's case it lasted about three days, and convalescence was rapid. Rotch regards two to three days as the average duration, and the recovery sudden; but in some of his cases the attacks lasted seven days, and in one instance two weeks, with slow convalescence. The attacks in Snow's patient varied from five to sixteen days in length, and in Rachford's patient from two to four days. In one of Gee's cases the duration was about ten hours, in another seven to ten days, in another eleven days.

In one of my own cases (II.) the worst attack lasted possibly a week. In another case (III.) the longest was ten days, but the final fatal attack only two days.

Even in the cases in which exhaustion has been extreme and vomiting incessant, convalescence is generally astonishingly rapid. The first sign of improvement is perhaps a diminution in the frequency of the vomiting, with return of some strength to the pulse and some warmth to the extremities, while the whole appearance changes for the better. Then vomiting soon ceases entirely, appetite returns, and the child is practically well except for a certain degree of weakness, which also rapidly disappears.

The *frequency* of occurrence of attacks varies greatly. In the disease described by Leyden the seizures came on at irregular intervals. Certain other writers, however, as has already been pointed out, have insisted on a decided regularity in the occurrence. In the recurrent vomiting which we have under consideration, on the other hand, no case reported has exhibited any tendency to distinct periodicity except Whitney's patient. In this case the intervals were generally three months. Holt's patient usually went five to six months without an attack, and Snow's from six to twenty-five weeks. In Rachford's cases the interval varied from four to eight weeks. So, also, in my own cases no regularity at all could be discovered. In Case I. the attacks occurred every few weeks during a few months, with no attack since. In Case

II. the intervals varied from two to fifteen months, with seven attacks in all; in Case III. from one to seventeen months, with eight attacks in all; in Case IV. from one to twenty-two months, with five attacks in all.

NATURE AND CAUSE. To the group of cases under consideration we can perhaps best apply the term "recurrent vomiting"—a name first employed by Gee. The title "cyclic," although popular, is misleading, because a cycle denotes a definite regularity in occurrence. "Periodical" likewise implies a certain degree of regularity. "Persistent vomiting," as it is called by Rotch, does not indicate that the attacks recur. There seems to be no term left us, then, but that of "recurrent vomiting."

This group of cases seems certainly different in nature from that which the cases described by Leyden, Rémond and others form, in which pain is such a prominent feature, and of which the purely neurotic nature seems assured. It differs, too, from the affection described by Fenwick, Symes and in part by Gee, in which dietetic errors are apparently the certain immediate cause. Yet even in recurrent vomiting, as I have limited the term, the cause and nature are very possibly not the same for all cases. It seems at least sure that the attacks depend in no way upon errors in diet. As the case-histories show, there is comparatively perfect health between the attacks, so far as the digestive apparatus is concerned. It is true that the prodromal symptoms are to some extent those of disturbed digestion, but they develop in spite of the greatest care in the diet, and seem to come from within the patient rather than from without. Moreover, when the attack has commenced the emptying of the stomach by vomiting gives no relief, as would be the case in ordinary acute gastric disturbances.

The points in common shared by recurrent vomiting, the painful periodic vomiting of adults, and the attacks of gastric pain, with or without vomiting, which occur in tabes, suggest the view that recurrent vomiting may be a gastric neurosis. That this is the true nature is the view of Rotch and of Whitney. Snow believes this to be true of his case, and regards the marked hyperchlorhydria of the vomited matter as confirmatory of this view. But, as previously stated, it is not proven nor even likely that hyperchlorhydria is the general condition. There is, indeed, decided ground for the belief that the recurrent vomiting of children is not a pure gastric neurosis, as the periodical vomiting of Leyden is claimed to be. Rachford makes the valuable suggestion that the attacks are due to lithæmia or some condition allied to it, and believes that there is the absorption and storing up in the system of some leucomaïnes. He considers the disease a lithæmic gastric neurosis allied to migraine. This view is supported by the fact that in one of his patients the symptoms changed into those of migraine as the child grew older. The condition of the urine in Holt's case points in the same direction.

Yet further study is needed. The examinations of the urine in two of my own cases are not entirely confirmatory. The occurrence of albumin and tube-casts in one of Rachford's cases, and of a terminal nephritis in two of my own, together with the post-mortem findings in one of them, certainly suggest that the disease is due to the presence of some toxic substance circulating in the blood—probably not uric acid, but some toxalbumin possibly allied to it. The presence of pruritus in two of my cases and the occurrence in one of them of diffuse articular pains after an attack point toward a disordered hæmic state. There very probably occurs a gradual storing up in the blood of some toxic substance, possibly developing primarily in the intestine, possibly formed in the tissues, until finally the limit of tolerance is reached and an attack takes place. This is the view likewise to which Pepper clearly leans.

The presence of acetone in the urine in the worst attacks of two of my own cases probably indicates that great disturbances of metabolism are present, and is a further proof of the existence of a toxæmia. Acetone itself, however, cannot be considered the poison which produces recurrent vomiting, since the symptoms of acetonæmia are not such as these cases exhibit.

We may naturally conclude, then, that recurrent vomiting may perhaps be a neurosis, but, if so, is one of toxic origin, in some way connected with faulty metabolism.

Regarding the influence of *age*, the disease may begin at any time in childhood, but in the majority of cases the first attacks were seen within the first three years of life, although generally after the first year.

The existence of a *neurotic* family *history* has been observed in a number of instances, and may well be a predisposing cause. In Rachford's cases a gouty family history is reported. Sometimes the child itself is distinctly neurotic and high-strung, as in the case of Whitney and in one of my own (II.). Occasionally, too, it has been reported that the children have been of rather delicate health; but in the majority of instances the general health has been excellent.

There may possibly be various immediate determining causes for an attack other than those mentioned. Exhaustion, fatigue, exposure to cold, and overexcitement have all been referred to in a general way by writers. But the actual association of these with attacks is most uncertain if we study the details of published cases. The most careful supervision of the life of my own cases failed to show the influence of these or any other immediately exciting causes.

Diagnosis. The diagnosis is not difficult when the attack is well established and is not the first from which the patient has suffered. As already pointed out, recurrent vomiting is to be distinguished from

the periodical vomiting described by Leyden. This latter affected adults, was always unattended by fever, and exhibited abdominal pain as a very prominent and often the most prominent symptom. The onset of some acute infectious disease can generally be distinguished by the development of other symptoms which are characteristic. Meningitis, particularly the tubercular form, may cause confusion at first. But the onset is much more gradual in the latter affection, vomiting is not commonly so frequent, and there is an increasing apathy and tendency to stupor, with rigidity, and finally with vasomotor and possibly ocular symptoms, all of which are quite distinctive. Nephritis is to be distinguished by a careful study of the urine at the onset. Acute indigestion is differentiated by the initial heavily coated tongue and other signs of a disturbed stomach, the character of the vomited matter at the beginning, the tendency for diarrhœa to develop soon in most cases, and the relief which vomiting usually gives after a few hours or a day have elapsed. Especially characteristic of recurrent vomiting is the tendency to repeated attacks which can in no way be associated with the ingestion of unsuitable food. Intussusception or other form of intestinal obstruction causes, perhaps, the greatest difficulty in diagnosis, especially as obstinate constipation is such a prominent symptom of recurrent vomiting in many cases. In one of my own patients (II.) obstruction was strongly suspected by the physician in attendance. Only a careful study of the case will enable a decision to be made, and then not always with certainty. Chief among the points of diagnosis in favor of recurrent vomiting are the tendency to repeated attacks and the absence of severe abdominal pain. As contrasted with intussusception there is also the absence of bloody mucous stools and of any discoverable tumor. Generally, too, although constipation can be temporarily relieved by treatment, the vomiting persists until the attack is about to terminate.

Prognosis. This is generally good, although not necessarily so. Recovery nearly always takes place, even from a condition of most alarming prostration. That cases do die, however, two of those reported show.

With regard to the likelihood of the recurrence of attacks, experience with the disease has not been sufficient as yet to allow of any positive conclusions being formed. It seems probable, however, that the disposition of the attacks to recur diminishes as the child grows older. This we can reasonably hope for, since we know that in children vomiting is brought on by many causes much more easily than in later life. In one of my own cases (I.) the affection seems to have disappeared. In another (II.) a longer time has now elapsed than ever occurred before. In one of Rachford's cases the disease was replaced by migraine as the child grew older. In Holt's case and in one of Rotch's the disease seemed to cease with increasing age.

TREATMENT. This is most unsatisfactory. The attack once developed generally goes on in spite of treatment until it exhausts itself. Being entirely ignorant of the nature of the exciting or more remote causes, our preventive treatment can be only experimental. Every element which can be even suspected as an etiological factor must be sought for and removed. Alterations in the diet should be tried; overwork and overplay guarded against, and constipation most carefully prevented. If prodromal symptoms seem threatening, a free purgative may possibly do good by removing poisonous matter from the blood. Care must constantly be taken to maintain a free action of the kidneys.

Should an attack have actually commenced the first indication is to open the bowels freely by an injection, or, still better, by saline cathartics or calomel if the child can retain them. But after the first effort it is well to administer nothing whatever by the mouth, whether food or medicine, thus giving the stomach absolute rest. The use of opening enemata should be discontinued and the bowel reserved for small concentrated nutrient enemata and the administration of medicine. Perhaps the best drugs to use in this way are chloral and the bromides in full doses. Morphine hypodermatically has certainly done good in some instances. This was notably true in my second case, where the narcotizing of the child seemed to be the means of saving his life. It should certainly be tried early in all bad cases. Stimulants by the rectum and strychnine and digitalis by the skin are to be used as needed. Hypodermoclysis is a treatment for severe cases which seems to offer the hope of benefit. Ice or counter-irritants to the epigastrium may be tried. As the disease advances, and especially if a lull in the vomiting occurs, it is safe again to try to obtain a free action of the bowels by the administration by the mouth of repeated doses of phosphate of soda or Rochelle salts. This is on the principle that if the vomiting is an effort by nature to eliminate the poison from the system free drainage through the bowel may aid in accomplishing this end. But there is nothing to be gained at any time by a mere unloading of the bowel by enemata, as though the constipation were the cause of the vomiting.

ANEURISM OF THE ARCH OF THE AORTA, WITH RUPTURE INTO THE SUPERIOR VENA CAVA.[1]

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AMONG the terminations of aneurism of the arch of the aorta one of the rarest is that which occurred in the case that forms the basis of this

[1] Read at the meeting of the Association of American Physicians, Washington, D. C., May, 1900.

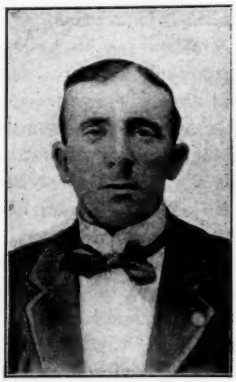
report. Most of the recorded cases are analyzed in the paper presented before the Association in 1890 by Drs. Pepper and Griffith. An interesting case in which the condition was recognized during life was subsequently published by Dr. Alex. Bruce[1] in 1895. I venture to record the present case because its characteristic features permitted a recognition during the life of the patient, and because it further illustrated some points in the prognosis which the analysis of previous cases have made clear.

I am indebted for the notes of the case and the privilege of reporting it to Dr. W. O. Xander, with whom I saw the patient.

C. H., a German-American, aged thirty years, a teamster. Weight, 150 pounds. (Fig. 1.)

He used no alcohol and smoked moderately. The family history was good; both parents living and well. He had two sisters and three brothers, of whom one is suffering from post-typhoid insanity.

FIG. 1.



From a photograph of the patient taken a short time before his illness.

The patient had scarlet fever at four and an attack of inflammatory rheumatism at twelve; at twenty-five, a second attack, which lasted four months. He had gonorrhœa three years ago, and was treated irregularly by a druggist. The running kept up for eight weeks; since then he has had difficulty in passing urine. A month before the fatal illness he had another attack of rheumatism, which kept him in the house for three weeks. His doctor told him to go to work to get the stiffness out of his bones. He accordingly went to work, hauling pipes, and felt very tired all week, and had shortness of breath on going up stairs. There was no swelling of his feet. His appetite was good.

Present History. At 3 o'clock, January 27, 1900, while at work, he suddenly felt a dull pain in the chest and a choking sensation in his throat. Immediately he began to swell, and was taken to his home, and Dr. Xander sent for at 5 o'clock. The pulse-rate was 90, temperature 96°, respirations 24. He complained of fulness and pain in the throat. His neck and face very much swollen and cyanosed. Examination of the throat was negative.

At 10 P.M. the swelling and distention of the veins extended down over the clavicles; there was no pain, but very great restlessness; he complained of dryness and choking in the throat.

Sunday, January 28th. No sleep. Temperature 95.4° (mouth), 99.5° (rectal); pulse 90, respirations 24 and labored, though the resonance was good over both lungs. The nose and ears were very much cyanosed. The veins on his forehead greatly distended, and there was free perspira-

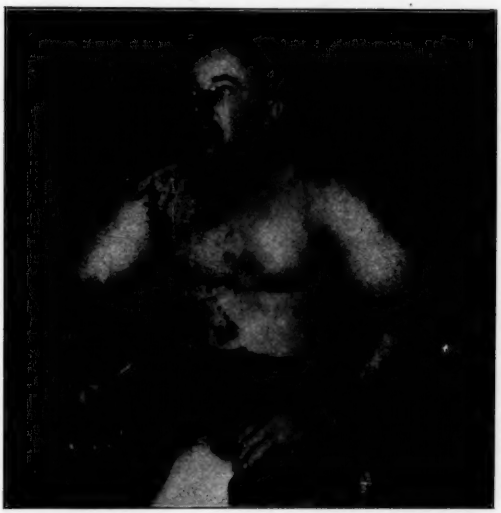
[1] Edinburgh Medical Journal, vol. xl., Part II., p. 896.

tion about his head. The lower half of the body was normal. Air hunger was marked. (Fig. 2.)

29*th*. Œdema and cyanosis have now involved the chest, both anteriorly and posteriorly to the waist line. Size of neck, eighteen and one-half inches. In health wore a sixteen collar. Choking became more marked. Thought he might strangle, so called in Dr. Roberts to intubate him. He suggested venesection.

30*th*. No sleep. Is not able to lie down. Neck measures nineteen and one-half inches. Opened cephalic vein and allowed twenty-one ounces of blood to flow out, which gave him considerable relief. Though no decrease in the size of the chest or neck, it was noticed that cyanosis was somewhat less marked.

FIG. 2.



Appearance of patient after onset of the disease. The dark discolorations on the chest and shoulder are ecchymoses.

31*st*. Dozed for a few minutes at a time sitting in a chair. Voided six ounces of urine. Bowels opened with calomel. Basham's mixture ordered.

February 1*st*. Temperature 97.4°, pulse 96; urine, ten ounces in twenty-four hours. Scrotum beginning to swell. Venesection (brachial), fifteen ounces. Œdema appears in both arms, right more than the left. Veins on back very prominent. Blue veins along the waist line fading away.

2*d*. Only sleeps a few minutes at a time in a chair. Complains of weight of scrotum. Went down stairs twice to wash.

3*d*. Swelling in arms increased; no œdema in feet. Size of scrotum is uncomfortable.

4*th*. Made deep puncture into scrotum and bandaged it tightly to hasten the flow of serum. Venesection, nine ounces.

5*th*. Says he feels better. Scrotum much reduced in size. Still dozing. Temperature 98°, pulse 100. Feet beginning to swell.

6*th*. Slept a few hours under chloral and potassium bromide, 10 grains each. Cannot lie down.

7*th*. Very restless during night, even irritable at times. No pain; right foot swells more than the left. Has headache. Urine, fourteen ounces.

9*th*. Temperature 99°, pulse weak, respirations 24. Appears to dream a good deal, but can readily be aroused and appears rational.

10*th*. Scrotum filling.

11*th*. Is very irritable, complains of sick stomach. Bowels open, no pain, wants to go down stairs.

12*th*. Scrotum increasing in size.

13*th*. Very uncomfortable; walks constantly. Sleeps only when drugged.

14*th*. Slept poorly during the night. Complains of pain in scrotum, which measures eighteen inches in circumference. Vertigo. Urine, ten ounces. Bowels open. Temperature 100°, respirations irregular, average 26; pulse 120, and weak. Ordered potassium acetate.

15*th*. Œdema of scrotum extends into both inguinal regions. Painful. Scarification gave immediate relief, by relieving pressure in the lymph channels. Bowels open freely. Urine, seventeen ounces.

16*th*. Feels better. Scrotum much reduced in size. No pain, only dragging. Urine, eighteen ounces. Swelling increasing in both lower limbs.

18*th*. Basham's mixture. Passed eighteen ounces of urine. Bowels open freely. Says he feels comfortable, only a choking and fulness in the throat. Is tired of room, and wishes to go down stairs. Has been smoking, and is hungry. Complains of headache.

20*th*. Is getting restless; headache; pulse weak and easily compressible. Sits in a semi-conscious state a great deal, and talks wildly. Cheers up when aroused.

21*st*. Pulse 130, weak; temperature 101°, respirations 28 and labored, though he is able to take a long, deep inspiration. Was very restless during the night. Delirious when dozing. In one of these spells he tried to jump out of a window. Early in the morning came down stairs. Bowels moved three times; urine, twenty ounces. Scrotum very large again, and in right leg swelling extends a hand-breadth above the knee; in the left almost up to the knee. Died in convulsion at 11.45 A.M. Conscious twenty minutes before his death.

I first saw the patient with Dr. Xander on January 31st. At that time I noted the extreme swelling of the neck, especially above the clavicles, and the œdema of the face, arms, and chest as far as the lower thoracic or upper abdominal region. There was a sharp line of demarcation formed by the limit of swelling and by a zone of deep cyanosis and ecchymoses, which passed around the body a little below the ensiform cartilage. The superficial veins of the neck and upper thorax were greatly enlarged, but the deeper veins of the neck could not be seen or felt on account of the great œdema. There were several ecchymoses on the right shoulder. The lower half of the body and the legs presented a wholly normal appearance. The

patient could not lie down, and suffered with great dyspnœa in any position.

Physical examination was somewhat difficult on account of the degree of œdema. The cardiac beat was vigorous, heaving and situated outside the mid-clavicular line in the sixth interspace. A second centre of pulsation was detected in the region of the right third interspace, but this was diffuse and feeble. It was best developed by having the patient lean forward so as to throw the thoracic contents against the anterior wall of the chest. There was no thrill. The radial pulses were nearly equal, the right seeming a little stronger than the left.

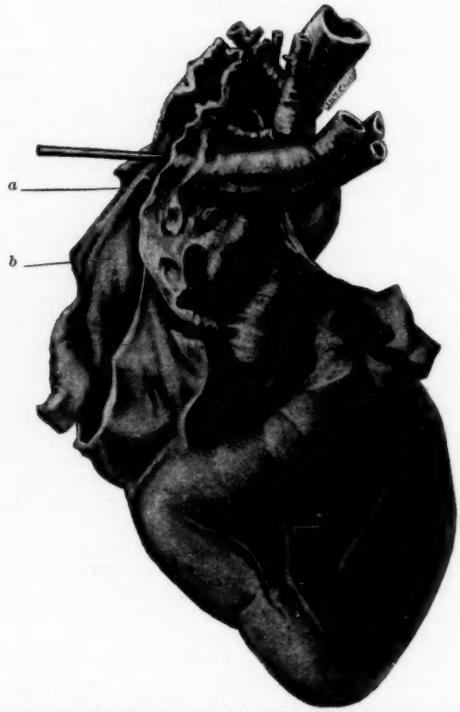
On percussion an area of dulness was found to the right of the sternum, extending from the second to the fourth ribs and from a line one and one-half inch beyond the right border of the sternum to the left side of the sternum. Below and to the left the dulness was continuous with that of the heart. The cardiac outlines were bounded, above by the third rib, below by the seventh, and the extreme left limit was three-quarters of an inch beyond the left mid-clavicular line. Pulmonary resonance was normal on both sides. The liver extended from the sixth rib to within an inch of the umbilical line. The spleen could not be felt.

Over the area of dulness to the right of the sternum there was a murmur which was immediately recognized as having the peculiar characters of a venous bruit. It was continuous, but much increased during ventricular systole. The diastolic portion was long and vibrating in character, the systolic short and rather harsh. Excepting for the peculiar humming character of the diastolic sound, the murmur did not differ greatly from the double murmur sometimes heard in aneurisms of the first part of the aorta or in aortic-valve disease. The murmur was transmitted to the right as far as the anterior axillary line, but scarcely at all to the left. It could not be heard much beyond the left border of the sternum. The systolic sound was distinct over the body of the heart, but the diastolic was scarcely at all transmitted in a downward direction. Abnormal phenomena were sought for in the arteries and veins of the neck and arms, but were wanting. The second sound of the heart was inaudible in the aortic region, and was only faintly heard over the pulmonary artery. The breath sounds were equal in the two sides, and fremitus was likewise equal. There were sonorous and sibilant râles and some subcrepitant crackles at both bases. Nothing abnormal was found in the abdomen.

Autopsy. Body of a man, about 5 feet 7 inches or 8 inches in height. Enormous swelling above the waist line and very slight below the waist, the feet and legs to the knees and the scrotum being involved. The latter was discolored, the skin being a grayish-blue color, evidently in a state of beginning necrosis. There were several incisions in it, at the bottom of which grayish-yellow putrid tissue was visible. The swelling of the upper part of the body was found to be due to tense œdema, and the skin was of a mottled character, bluish in certain areas, and in some places showing distinctly enlarged veins. There were a number of incisions near the right shoulder, and about both arms where punctures had been made during life. On incision through the middle line the skin and subcutaneous tissues were found to be hard, and could be cut only with difficulty. Dark venous blood flowed freely from the incised tissues above the waist line. On close inspection it was found

that the veins of the subcutaneous tissue were greatly enlarged, though flattened out by the pressure. They presented the appearances of the uterine sinuses, and the blood flowed in steady streams. Below the waist line the incision was entirely dry, as the incision is customarily at autopsies. On removal of the sternum and ribs both pleural cavities were found to contain large quantities of serum, but this was particularly the case on the right side, where the effusion extended quite to the clavicle, and the diaphragm was depressed. The liver was pushed

FIG. 3.



Anterior view. The aneurism is concealed behind the pulmonary artery, the right auricle and the superior vena cava (*b*), which is opened to show the point of rupture (*a*). The probe passes into the innominate vein.

down and extended to within 2 or 3 cm. of the umbilical line. The lungs were considerably compressed and œdematous. On section frothy liquid flowed from the bronchi, and the substance of the lungs throughout was œdematous. After removal of the lungs, the azygos veins and intercosal veins were observed and found greatly enlarged. The large veins at the root of the neck could not be well identified, but were evidently enlarged, though bleeding from the subcutaneous veins had probably reduced their size, as the amount of blood lost in this way

was very considerable. The pericardium was incised, and was found to be thickened, and the tissues in the region of the remnant of the thymus were especially œdematous and indurated. The appearance was that of a secondary sclerosis following long continued œdema. The heart was found greatly enlarged, and its substance evidently quite flabby. The color as seen through the epicardium was decidedly pale and somewhat yellowish, and the course of the coronary vessels was marked by yellowish deposits of fat. On incision the substance of the left and the right ventricles was found to be very soft, and the color grayish-yellow. The right ventricle was particularly affected, and the

FIG. 4.

Lateral view, looking into the opened vena cava. The point of rupture is indicated at a.

walls so much thinned and weakened that the papillary muscles could be distinguished from the outside as nodular areas of hardening. On incision into the chambers, fluid blood was removed, and the cavities on both sides were greatly enlarged. The tricuspid orifice was quite evidently dilated; the hand could almost be passed through this orifice without stretching it. The pulmonary orifice and artery were first laid open and the artery was apparently somewhat dilated, but otherwise normal. The aortic orifice was then opened and the valves were found to be stretched so that they were evidently incompetent. The sinuses of Valsalva were pouched, and the borders of the sinuses as well as the mouths of the coronary arteries were densely sclerotic.

An aneurismal sac was discovered on the ascending portion of the aorta, extending toward the right. It was saccular in form, and about two and one-half inches in diameter. The endothelial lining was roughened and had atheromatous patches, especially in the upper and right side of the sac. There were a few soft clots within the aneurism, but nothing suggesting the formation of firm coagula. The sac compressed the superior vena cava from its entrance into the right auricle to the point of junction of the right and left innominate veins. The latter (left innominate) was somewhat compressed at its termination. The veins above the point of compression were greatly distended. (Fig. 3.) The aneurism was firmly attached to the vena cava, and a perforation was found in the latter just below the junction of the innominate veins. This communication was about a half inch in length and a quarter inch in width. The perforation occurred in the part of the aneurismal wall in which the atheromatous plates referred to were found. There had evidently been great thinning of the sac wall in this situation for sometime prior to the time of rupture. (Fig. 4.)

The lungs were intensely œdematous, and on section a large amount of frothy serum exuded. In places there were small hemorrhagic extravasations.

The liver was congested, though not extensively. The structure was in other respects quite normal. The kidneys, spleen, and other abdominal organs presented no noteworthy features.

It was quite evident at the first examination of the patient that he was suffering with aneurism of the first part of the aorta, and it was also clear that the superior vena cava had become obstructed. The only difficulty in the case was the determination of the cause of the obstruction. It was possible that this might be due to a sudden dilatation (without rupture) of the aneurismal sac, or to a clot in the vein, or to the condition actually present—rupture of the aneurism. The fact that aneurismal sacs may suddenly expand under the influence of strains is of course well known, and it is easily possible that such a dilatation might bring about a sudden compression of the vena cava, with symptoms like these described. A continued venous bruit might further be caused by such a narrowing. In the second place, a slow thrombosis of the vena cava above a constriction caused by pressure of an aneurism could also terminate in complete venous occlusion by separation of the clot and its lodgement lower down in the narrowed part of the vein. In this case, however, the symptoms would be more likely to develop more slowly than was the case in our patient, though the immediate effect of such a thrombosis with secondary dislodgement would be a sudden obstruction of the cava. The possibility of aneurismal rupture causing symptoms such as were present is well illustrated in the thirty cases collected by Pepper and Griffith. Their analysis showed the principal diagnostic indications to be the following:

1. Cyanosis, œdema, coldness, and distention of the veins of the upper part of the body with other evidences of obstruction to the circulation of the blood in the tributaries of the superior vena cava.

2. The suddenness of the onset of the symptoms.

3. Evidences from physical examination of the presence of a tumor in the thorax, and the probability that this is aneurismal.

4. The existence of a murmur characteristic of a communication between an artery and a vein.

These symptoms are sufficiently distinctive to establish the diagnosis, particularly if the last is well marked. The only difficulty in my own case was the fact that the humming diastolic portion of the murmur was not distinctive after the first examination, and during the remaining weeks of life did not differ greatly from the diastolic element of a murmur caused by an aneurism of the aortic arch with dilatation of the valve orifice or by simple aortic valve disease. One point of great significance was the right lateral transmission of the murmur and the absence of the murmur over the body of the heart, at the ensiform, and at the apex. Regurgitant aortic murmurs are so commonly propelled in these directions that it seemed clear that the bruit present in the case was of a different sort. On this ground the possibility of simple constriction of the vena cava by a sudden distention of the sac was excluded, and the humming murmur referred to a rupture rather than to a venous stenosis or aortic regurgitation. The autopsy showed the likelihood of the existence of some aortic regurgitation, but this had certainly not produced characteristic signs.

A matter of prognosis of interest is the probable duration of life and the possibility of cure. In the case of Damaschino and Lavin, in which recovery occurred, there is sufficient evidence to warrant the diagnosis, and a study of the specimen in my own case is convincing that recovery might occur. After the venous system has been engorged the backward and forward flow through the orifice of the rupture is apt to be much less than the location and nature of the lesion would make us imagine. Under these circumstances a clot might form that would obstruct the ruptured aorta. These considerations would lead to a thought regarding treatment, viz., that too active venesection may do injury by depleting the venous channels and thus restoring the strength of the systolic current through the rupture. Venesection should be performed when the danger to life is excessive, but ought to be moderate in the amount of blood taken.

As to the duration of life, the analysis of published cases establishes the surprising fact that some cases have lived for weeks and even as much as seven months after the rupture. In the case here reported the duration was twenty-four days, a long continuance considering the early severity of the symptoms and a further evidence of the possibility of occasional recovery.

SUBPECTORAL ABSCESS.[1]

By John Herr Musser, M.D.,
of Philadelphia.

I have seen in quite recent years three cases of subpectoral abscess under the following circumstances. Although belonging within surgical lines, they presented such clinical features that it was thought well to have a general practitioner see them, hence my experience. A few of the symptoms are worth emphasizing, as well as the phenomena which made it my privilege to observe them.

Case I.—A previously healthy man, aged about thirty-five years, was admitted to the wards of the Presbyterian Hospital, suffering from an abscess of the chest walls under the pectoral muscle. With the local symptoms, which were not unusual but characteristic, there were some rigors and intermitting fever. There was also some mild arthritis. The patient was desperately ill, and my colleague asked me to see him to determine whether ulcerative endocarditis prevailed or pyæmia had begun; in other words, whether the infection was limited, or whether other structures and the blood were involved. The surgeon was deterred by the heart murmur and the pyæmic symptoms to give an anæsthetic or shock the patient by an operative procedure, which would, he feared, be useless. I felt the heart murmur was due to anæmia and flabby dilatation, intensified by the febrile process. The operation afforded prompt relief.

The feature of prominence was the excess of general symptoms (fever, etc.) in proportion to the local phenomena. No cause for the abscess was determined.

Case II. was also a patient in the Presbyterian Hospital, presenting the local signs of subpectoral abscess. He was a rather delicate man, twenty-two years of age, with high fever, sweats, rapid heart, and some embarrassed breathing. Inability to explore the chest thoroughly by physical examination led to the fear that the abscess was secondary to an empyema. I was asked to consider this question. Empyema was excluded, based upon the negative evidence on examination of the lungs posteriorly and laterally. Surgical treatment brought about immediate relief.

Trauma was the primary etiological factor. Its resemblance to empyema was the feature in this diagnosis.

Case III.—A farmer of five and twenty years, robust, while training a colt, requiring physical and psychical strain, was drenched by a passing storm. This was followed by an attack of bronchitis and by apparent rheumatism of the right pectoral and shoulder region. His family physician prescribed salicylates. There was no relief and no

[1] Read at the meeting of the Association of American Physicians, Washington, D. C., May, 1900.

signs of local infection. At the end of fifty-six hours he had a chill, followed by high fever. The bronchitis continued; the chest pains, limited to the right upper anterior half, were severe, and sweats were alarming. The symptoms continued one week. After the first examination the chest surface was not exposed for further study. Examination with the ear and by percussion was negative, for soon the mass under the pectoral muscle prevented the transmission of sound. With the continuance of fever and sweats the patient lost flesh and strength rapidly. The blending of the symptoms of bronchitis and those of the infection led the attending physician and his colleague to make a diagnosis of acute tuberculosis. I was asked to see the case, to decide upon climatic treatment. Fortunately I could demonstrate the presence of a considerable mass under the pectoral muscle, and could exclude any signs of localizing tuberculosis. I could not with the data at hand exclude acute general tuberculosis, although I was certain the grave general symptoms were due to the subpectoral infection. Twenty-four hours later Dr. John B. Deaver opened the abscess, the extent and apparent virulence of which surprised him. The patient promptly recovered. Cultures yielded the streptococcus. Trauma caused the subpectoral bruise, leading to infection.

Here, again, the severe septic symptoms, unfortunately, coincident with the attack of bronchitis, led to an error in diagnosis.

There are two brief varieties—acute or phlegmonous, and chronic or cold, abscesses. The literature contains many cases, especially of the latter.

Acute or Phlegmonous Suppuration.

Etiology. 1. Traumatism is probably the commonest cause (Cases 1, 16, and 17), such as blows over the pectoral muscle. Excessive use of the muscle has been given as an occasional cause (Martin).

2. Next to traumatism extension of inflammation from some other point in the body, either by metastasis (Case 5) or by extension through the lymphatic channels (Cases 2, 6, 7, 9, 10, 21, and 22), as in those cases of suppuration following infected wounds on the arm or inflammation of the breast.

Pleurisy, either suppurative or non-suppurative, recent or old, is frequently the cause (Cases 4 and 15).

3. Rarely the malady seems to be idiopathic (Cases 11, 12, 13, and 20).

4. Taking cold has been described as a cause (Martin).

Pathology. The condition often proves fatal, so there have been a number of autopsies reported, and the pathology of the condition has been quite thoroughly studied. Certain anatomical considerations may be reviewed that will throw light on the phenomena observed. On the deep surface of the pectoral muscle is a cellular area lying on the ribs and intercostal muscles separated from them in the upper and outer portion by the lesser pectoral muscle and the costocoracoid membrane. To the outer side lies the axillary space separated from the subpectoral

space by the axillary fascia. There has been described a bursa interposed between the deep surface of the greater pectoral muscle and the ribs. Beneath the parietal pleura is a cellular tissue rich in lymphatics. These lymphatics communicating with the lymphatics in the cellular tissue beneath the pectoral muscle are of great importance as explaining the transmission of infectious agents from the pleura to the pectoral muscles.

The abscess usually occupies the cellular tissue between the deep surface of the pectoralis major and the plane of the ribs and intercostal muscles. The pectoral fascia, investing, as it does, the pectoralis major, offers an almost impassable barrier to the extension of suppuration beyond the muscles. Cases have, however, been reported in which the pus travelled along the pectoralis minor and entered the axilla along with the great vessels and nerves (Cases 15 and 21). There is often found, together with the pectoral abscess, an intrathoracic abscess, either subpleural or intrapleural, the external and internal cavities communicating through small openings. A case of pectoral abscess opening into the anterior mediastinum has been reported (Case 16); or, as in some cases, presenting no communication whatever. The latter are to be explained by the distribution of the lymphatics already mentioned. The suppuration, as it has been said, is limited to the pectoral muscle, yet within these limits it may be either diffuse (Case 13) or circumscribed.

Symptoms. An interval of several days frequently elapses between the infection or traumatism and the onset of symptoms, but the symptoms may rapidly follow the cause. The commonest early symptom is a vague tenderness somewhere in the muscle. This may precede the development of the tumor by as much as a week. Soon after this movements of the arm become painful. Hence, in some instances the diagnosis of rheumatism. Then follow in most cases the general symptoms: Fever, chill, loss of appetite, coated tongue. Then the local signs appear. There may be either a well circumscribed tumor, or the whole pectoral region may project forward; the latter is usual. Pain and tenderness are usually well marked. The skin, at first normal in color and temperature, becomes red, hot, and later œdematous, especially along the lower border of the pectoralis major, although in the third of my list of cases no local signs were noted for one week. The infraclavicular fossa is effaced by the swelling and the axilla encroached upon. Palpation reveals fluctuation. At first, when the tumor is deep seated, fluctuation may not be detected; but when considerable pus has formed, and there is a tendency to point toward the inferior border of the pectoralis major, it can always be elicited. The following method given by Prieur will usually be found satisfactory: If it is the right side that is under examination, place the fingers of the left hand under

the anterior fold of the axilla, the pulp of the fingers being forward, the right hand over the pectoral muscle. With the fingers in these positions alternate pressure is made, as is usual in looking for fluctuation. The axillary vein and lymphatics of the arm are pressed upon by the swelling, giving rise to œdema of the upper extremity.

Such external abscess follows interlobular empyema. In two instances in children the pus had found its way to the surface in the third interspace, presenting a globular tumor.

If the abscess communicates with another inside the thorax, other symptoms are added which make the diagnosis somewhat difficult. There is apt to be, in addition to the foregoing symptoms, cough and dyspnœa, together with the physical signs of a mass within the thorax. The external abscess may be affected by respiratory movements. It becomes tense on inspiration, flaccid on expiration. There is an impulse on coughing.

The infection is at times of a pyæmic nature. The symptoms rapidly become typhoid, and death follows. These symptoms were noteworthy in my cases, and led the local symptoms to be considered of minor importance in the case.

Diagnosis. The authors have little to say concerning this. When the abscess is entirely extrathoracic, careful physical examination would exclude any intrathoracic trouble. When there is a communication with an abscess within the thorax the diagnosis becomes more difficult. It will be considered below, under the heading of Cold Abscesses. In the early stage of the acute abscess, when the only local sign is tenderness and the general symptoms have not developed, the condition might be mistaken for rheumatism or intercostal neuralgia. Case III. of my list was thought to be rheumatic at first. But the diagnosis could not long remain doubtful on account of the course of the process.

Cold Abscesses.

Chronic or cold abscess in the region of the pectoral muscle. Cold abscesses of the thoracic wall have attracted considerable attention from the profession during the last half century. It has been the subject of numerous monographs.

Etiology. Since the pathology of tuberculosis has been understood the nature of these cold abscesses has been made clearer. They are usually, perhaps always, tuberculous. They originate either primarily in the muscle (Morestin) or secondary to some other tuberculous focus, such as osteitis of ribs, pleurisy, or tuberculous cavity in the lung. The tubercular diathesis is commonly present. Traumatism is frequently a determining cause.

Seats. 1. Antero-superior part of the chest, particularly near the costosternal articulations.

2. Posteriorly near the angles of the ribs.
3. The lateral portions of the chest.

We will consider only those abscesses occurring in the neighborhood of the pectoral muscle. These, indeed, are the most frequent.

Pathology. It may be primary in muscle, being the first focus of infection within the individual, or more commonly it is secondary to tubercular foci, as already stated. The abscess frequently occupies the cellular tissue on the deep face of the pectoralis major, and may involve the muscle itself. It is in these chronic abscesses that communications with intrathoracic collections of pus are most common. The primary abscess is usually intrathoracic, having its origin either in a tuberculous osteitis or periosteitis of the internal face of the ribs or in a subpleural collection.

Small abscesses in the subpleural tissue have attracted considerable attention, and are thoroughly studied in the monograph of Marmarian. They probably originate by transferrence of infectious material from the pleural cavity through the lymphatics to the subpleural tissue without suppurative inflammation of the channels through which they pass. These subpleural collections, having their origin either in the pleura or in the ribs, increase in size, burrow through the intercostal muscles, and infect the subpleural collections without actual extension of inflammation by continuity.

Symptoms. Localized tenderness develops long before the abscess in most cases, although occasionally the trouble may not be noticed until the abscess is of a considerable size. There are no general symptoms except those of the tuberculous diathesis. Local symptoms are characteristic, and usually quite different from those of acute abscesses. At first the tumor appears, varying in size from that of a pigeon-egg to a small orange. It is firm, rounded, not adherent at first; the skin is free over it, not reddened or hot; fluctuation is indistinct at first. When the abscess communicates with an intrathoracic collection or arises from a carious rib, it is adherent to the deep structures; later fluctuation becomes distinct, especially at the centre, while the periphery of the mass remains firm and the skin is apt to become adherent. Eventually the abscess points. Its course is slow, lasting over a year or two.

Diagnosis. Before the tumor appears the localized tenderness may suggest intercostal neuralgia. The latter may be differentiated by reference to the points of Valleix, which, of course, are tender in neuralgia, while the tenderness of cold abscess may be at any point. After the tumor has appeared, on account of its indolent character it may be mistaken for a hydatid cyst, syphilitic gumma, lipoma, or a sarcoma. It can be diagnosed from these tumor formations by reference to the points commonly given in surgical text-books. Yet, it must be con-

fessed, the diagnosis is often difficult. It may be necessary to resort to exploratory punctures.

When the abscess communicates with an intrathoracic collection (indicated by reducibility and changes in tension during respiratory movements), it becomes necessary to determine whether the pleural cavity or the lungs are involved. The difficulty lies in the fact that the subpleural abscess closely resembles the ordinary pleural abscess or empyema, especially when the latter is encysted. A free collection of pus within the pleura may be distinguished by its movability. In either case the history of an acute pleurisy might throw light on the diagnosis. Radat gives the differential diagnosis between subpectoral abscess originating within the thorax and those having their origin without. In the case of the former there is a history of some illness, such as pleurisy or "suppurative pneumonia." The fluctuation appears as soon as the tumor appears. If there has been pleurisy the respiratory murmur is absent, and there is dulness on percussion. If the abscess has its origin within the lung there is dulness and bronchial breathing and other signs of "chronic pneumonia, such as moist râles, cavernous breathing, etc." The writer must emphasize the great value of the history indicating the sequence of pathological events, with the physical signs and the immediate occurrence of fluctuation.

The following cases are gathered from the literature to illustrate the statements made above:[1]

CASE 1 (Briband).—Etiology. Blow on the right breast. Symptoms, painful swelling limited to the pectoralis major appeared soon after injury. There was immobility of the arm; skin was not involved; fluctuation just below the clavicle; œdema of the surface. Operation. Death in three weeks from sepsis. Autopsy. Abscess of the posterior surface of the muscle, limited by its aponeurosis; adherent pleura opposite the abscess; peritonitis.

CASE 2 (Briband).—Etiology. A man, aged forty-three years. Angioleucitis from furuncle on the arm, followed by enlargement of the axillary glands. Symptoms, abscess limited to the pectoral muscle, causing painful swelling of the whole region. Skin hot, red, and œdematous; arm useless. Fluctuation at inferior border of muscle. Operation. Recovery. Operation revealed large cavity under the pectoral muscle containing bloody pus.

CASE 3 (Briband).—Etiology. A woman, aged thirty-five years. Followed a cured mammary abscess. Interval not stated. Symptoms: First, tenderness at the insertion of the pectoralis major, then swelling of the whole pectoral region. Redness of the skin; obscure fluctuation below; marked general symptoms. Operation. Recovery. Was diagnosed *rheumatism* at first.

CASE 4 (Briband).—Etiology. From an old pleurisy. Symptoms: Began with chill and other general symptoms, followed by swelling of

[1] I am indebted to Dr. Fred. Howard for the review of the literature and other valuable assistance.

the pectoral muscle. Terminated in death. Autopsy. Subpectoral abscess extending into the axilla. Two localized abscesses in the pleura in the pectoral region. An old pleurisy with two litres of fluid.

CASE 5 (Renant).—Etiology. An abscess at the elbow, of unknown origin. Two abscesses developed—one at the anterior fold of the axilla, and one opposite the middle of the sternum. Purulent cough followed; pressure over abscess produced gurgling; subcutaneous emphysema toward the clavicle. Terminated in death. Autopsy. Subpectoral abscess, involving muscle opening through the third interspace, through the pleura into the lung. No signs of tuberculosis in the lung. Pleura adherent only at the point of perforation.

CASE 6 (Prieur).—A young sailor, perfectly well, developed a swelling limited to the pectoral; freely movable; painful, indistinct fluctuation; skin red; no fever or other general symptoms. Diagnosed as *syphilitic myositis*. A deep incision through the pectoral gave vent to pus. Patient had an infected finger.

CASE 7 (Prieur).—A man, aged twenty-eight years. Blow on the finger caused inflammation, which recovered without treatment. Six days after development pain in the axilla, fever, and anorexia. Pectoral muscle tender and swollen. Motions of the arm painful. Incision at lower border of the muscle opened a pectoral abscess.

CASE 8 (Prieur).—Man, aged sixty-two years. Anterior axillary wall swollen, tender, and hard. Faint fluctuation; subpectoral abscess opened by incision along lower border of muscle.

CASE 9 (Lesigne, quoted by Prieur).—An abrasion on finger, followed by pain in the pectoral muscle; then general symptoms. Great pain on motions of arms. Pectoral muscle then became swollen. Subpectoral abscess opened by incision. Case was diagnosed as *acute articular rheumatism* before abscess developed.

CASE 10 (Lesigne, quoted by Prieur).—Abrasion of finger. Angioleucitis extending up the arm, followed in six days by swelling of the axillary glands. Œdema and immobility of the arm. In twelve days pectoral abscess. Incision below pectoral muscle. Death.

CASE 11 (Watson).—A pulsating swelling below the clavicle, nothing in history to account for it. Pulsation ceased. Signs of pus increased. Abscess opened and ordinary pus was evacuated. Pulsation probably due to proximity to axillary or subclavian artery.

CASE 12 (Frost).—Patient was a pronounced alcoholic. Had been on a spree; was admitted to the hospital unconscious. The day before felt ill, and the right arm was stiff; examination showed pectoralis major prominent and œdematous along the lower border. Arm œdematous. No operation. Death in twenty-four hours. Autopsy showed diffuse suppuration under the pectoral muscle.

CASE 13 (Martin).—Case of subpectoral abscess from excessive use of the muscle.

CASE 14 (Velpeau).—Began with a chill and vague pains in the left side. The next day general symptoms developed. Pectoral muscle became tender, swollen, and indurated. Then œdema and fluctuation developed. Abscess opened along lower border of muscle. Symptoms were relieved. After two days the fever rose and pleural effusion appeared. The patient sank and died after nine days. Autopsy showed subpectoral abscess extending along the pectoralis minor into the axilla. The pleura contained two circumscribed abscesses about opposite the

subpectoral abscess. Both had thick walls, and were evidently old. There was no communication between them and the external abscess. The pleura contained two litres of fluid, the lung was normal.

Case 15 (Allen, H.).—Patient admitted to the hospital seriously ill. Weak pulse and rapid respiration. Examination showed the usual signs of subpectoral abscess, with one peculiar symptom, namely, appearance of a wave at the summit of the collection during expiration. Operation; death. Autopsy showed subpectoral abscess communicating with the anterior mediastinum through an ununited fracture in the third rib.

Case 16 (Scholz).—Young man, aged twenty-three years, perfectly well, kicked in the right breast two months before admission. The pain of the injury disappeared, but was followed by a swelling extending from the sternum to the border of the pectoral, from the second to the fifth rib. Skin red, slightly higher in temperature. When the pectoral muscle was put in action, swelling became harder and the inner portion bulged forward. There was no pain, only tenderness on pressure. No general symptoms. Operation followed by erysipelas, pyæmia, and death. Autopsy showed caries of the fourth rib, subpectoral abscess, emboli of the lung, peritonitis.

The author reports a case from Pitha's clinic of traumatic subpectoral abscess due to shot of revolver. The infection extended to the abdominal cavity.

Case 17 (Cheever).—A young man, possibly syphilitic, otherwise perfectly well, developed swelling in the region of the pectoral, partially obliterating the axilla, considerable pain, abscess pointed.

Case 18 (Cheever).—Young unmarried woman. Abscess under the left pectoral, the left breast prominent, superficial veins engorged, the left axilla partly filled, general symptoms very marked; operation; recovery. The author pointed out the great resemblance to mammary abscess and to subcutaneous emphysema.

Case 19 (Werner).—Young girl, aged seventeen years, began with pain in the pectoral region and immobility of arm. Swelling followed at the border of sternum at level of third rib. Skin at first normal, later reddened, general condition good. Abscess opened, large subpectoral cavity found. Recovery.

Case 20 (Werner).—Woman, aged thirty-three years. Sometime before had a wound of the finger that healed perfectly. Eight days before observation, developed pain in the axilla, and infraclavicular region filled up, swelling of the pectoral region, general condition good. Axillary glands were irritated and enlarged; abscess opened, found to extend in the axilla.

Case 21 (Werner).—Boy, aged fourteen years. Developed traumatic scarlet fever (?) from an infected wound of one finger. Then, after subsidence of rash, swelling developed in the pectoral region, which was opened, giving exit to yellow pus. Extensive cavity extending nearly to the clavicle. Recovery.

Case 22 (Werner).—A man, aged thirty years, seized with severe pain in left arm, which extended to the pectoral region, was followed by development of an abscess. The pain in arm probably due to swelling of axillary gland. Operation; recovery.

Case 23 (Stiftung).—Illustrating communication of abscess with lung. Patient, aged forty-six years; day laborer. Had been suffering for eight days, without known cause, from an abscess under the left collar

bone. The clavicular portion of the large breast muscle was gone. The left lung was tuberculous. On the tenth day afterward, in the morning, the abscess broke and the hand showed, on pressure, a knotted mass. The patient was breathing with difficulty. In the night he had a severe coughing attack, mucous expectoration came freely, and the abscess broke into the lung. It contained air and fluid. Pressure with the finger would empty the abscess, and a full breath would fill it with air. The coughing continued very severely, excited by the pressure. The abscess grew smaller, and in fourteen days there was only a little hole and a little fluid. Communication with the thorax was almost closed up, and fourteen days after that there was no fluid discharged.

Bibliography.

Allen (H.) A Case of Pectoral Abscess Presenting Some Unusual Features. Transactions of the Pathological Society, Philadelphia (1871-1873), 1874, iv. 234-237. Also Philadelphia Medical Times, 1871, ii. 46.

Auclert (E.) Contribution a l'étude des abcès des parois thoraciques á formre pseudo-pleurétique, Lyon, 1893.

Banks. Abscess in the Wall of the Chest Opening into the Lung. Dublin Journal of the Medical Sciences, 1868, xlvi. 473.

Bonnaud (C.) Abcès froids des parois thoraciques, Paris, 1892.

Bousquet (H.) Abcès froids des parois thoraciques consecutifs aux périostites externes chroniques. Arch. gén. de méd., Par., 1878, 7 s., i. 288-313.

Briband (F. E.) Les abcès sous-pectoraux, 4to, Paris, 1856.

Cartier (P.) Abcès periostiques de la paroi thoracique, Paris, 1882.

Cheever (D. W.) Abscess Under the Pectoral Muscle. Boston Medical and Surgical Journal, 1873, lxxxviii. 166-169; Ibid., 1878, xcix. 517. 519.

Citerne (P.) Des abcès froids des parois du thorax, Paris, 1884.

Crisp (H.) On a Case of Abscess of the Thoracic Walls Simulating Pleuritis and Empyema. Lancet, London, 1848, ii. 123.

Franche (L. P.) De la pleurésie consécutive au phlegmon de la paroi thoracique.

Frost (W. O.) Subpectoral Suppuration; Septicæmia; Death. Lancet, London, 1876, ii. 854.

Jamini (R.) Phlegmon diffus de la paroi latérale du thorax; mort rapide. France méd., Par., 1881, xxviii. 669-672.

Lebatard (H.) Contribution a l'étude des abcès froids des parois thoraciques, Paris, 1887.

Leplat (E.) Des abcès de voisinage dans la pleurésie; pathogénic et étude clinique des abcès des parois thoraciques. Arch. gén. de méd., Par., 1865, i. 403, 565.

Marmarian (J.) Contribution a l'étude des abcès froids de la paroi thoracique latérale, Paris, 1896.

Marshall. Abscess Beneath the Pectoral Muscle. Lancet, London, 1870, ii. 634.

Martin (A.) Du phlegmon pectoral et deltoidieu. Mouvement méd., Par., 1876. xiv. 393.

Morestin. Abcès tuberculeux du grand pectoral. Bull. Soc. Anat. de Par., 1896, lxxi. 784.

Musser (John Herr). Subpectoral Abscess. Transactions of the Association of American Physicians, 1900.

Pichon (A.) Contribution a l'étude des abcès froids periostiques du thorax, Paris, 1886.

Prieur (H. A.) Contribution a l'étude du phlegmon sous-pectoral, Paris, 1896.

Radat. Abcès sous-pectoral ouvert dans le poumon et les bronches. Ann. de la chir. franc, et etrang, Paris, 1845, xiv. 257-272.

Renant. Abcès sous-pectoral ouvert directement dans le poumon. Bull. de la soc. anat., 1882, lvii. 321-324.

Sholz (W.) Chronischer, submuskulärer, traumatischer absess unter den rechten Brustmuskeln: Punktion; Erysipel; plotzlicher Tod. Allg. mil-artzl. ztg., Wien, 1868, ix. 271-274.

Souligoux (C.) Pathogéne des abcès froids du thorax, Paris, 1894.

Tillaux. Abcès froids de la paroi thoracique. Rev. prat. d. trav. de méd., Par., 1896, iii. 249,

Velpeau. Abcès sous-pectoral ayaut fuse dans l'aisselle; eparchements pleuretiques; mort. Gaz. d. hôp., Par., 1854, xxvii. 13.

Vesseau (Jules). Abcès idiopathique du parois thoracique, Paris, 1879.

Watson (S.) Pulsating Swelling below the Right Clavicle Simulating Aneurism, but Terminating in Abscess. Medical Times and Gazette, London, 1865, i. 519.

Werner. Drei Falle von Abcess billdung unter dem Musculus pectoralis. Ztschr. f. Wundärzte u. Geburt., Winnenden, 1882, xxxiii. 323, 332; also Stuttgart, 1867, xx. 178-180.

BIOLOGICAL STUDIES WITH REFERENCE TO PATHOLOGY.

(A DELICATE TEST FOR TOXIC STATES OF THE BLOOD.)[1]

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AUTO-INTOXICATION and toxic states of the blood have been subjects of much discussion, and the theories which are advanced are not without a sound clinical and pathological basis. At the present epoch in medicine gratifying results may be hoped for when there is reason to believe that disease is caused by toxic substances present in the body which assume the importance of being the essence, the *vera causa*, of disease. This idea is rapidly becoming a prominent factor in the etiology of disease.

Neurologists have expressed the opinion that the toxic theory is destined to clear away much of the present vagueness regarding the pathogenesis of nervous and mental disorders. The structural changes found in many diseases may after all be mere manifestations of a toxic state of the blood due to poisons produced in the body itself or introduced from without.

This doctrine is strongly supported by many clinical facts. The most distressing symptoms have been promptly relieved when this condition was recognized. Mental confusion and depression, epilepsy, hysteria, neurasthenia, and even more profound mental states, as melancholia and mania, have been cured by remedies directed to relieve obstinate constipation, improve digestion and assimilation. Many reasons, therefore, seem to show that toxæmia has a wide-spread effect on disease, and it is of great importance that these conditions are recognized early, for the continuous action of toxins produce irretrievable damage and annul the working power of vital organs.

In the past year the author has studied the changes occurring in the cells of some of the protozoæ and algæ when treated with various toxic substances. The spirogyra, a species of the algæ, was found to be the most suitable for the study of intracellular changes. Among the plants growing in still and slowly flowing waters the spirogyra is probably the most common. It forms a thick green coating on the surface, composed of delicate fibres; it is easily recognized, and under the microscope the threads appear as linear aggregations of the cells. The cells forming the threads are cylindrical, transparent, and are arranged

[1] Read at the thirty-fifth annual meeting of the Michigan State Medical Society, July 12, 1900.

end-to-end in single rows, surrounded by a cellulose wall, separated from the adjoining cell by a partition composed of the same substance. Lining the inner surface of the cell wall and separating from it the cell protoplasm is the protoplasmic cylinder, which consists of a very delicate double membrane (the inner and outer protoplast), surrounding the chlorophyl spiral bands or chromatophores and protoplasm. The spiral bands vary in number from one to eight or more; they have a regular arrangement, and are of a beautiful light-green color, in which are embedded numerous star-like bodies, the pyrenoids, and glistening

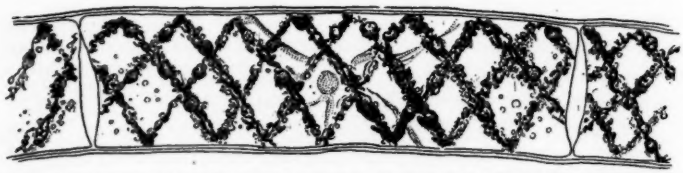
FIG. 1.

A thread of spirogyra majuscula in its natural state, as seen under the magnifying power of a No. 3 Leitz objective with No. 4 eye-piece.

FIG. 2.

A drawing from nature under the magnifying power of a No. 3 Leitz objective with No. 4 eye-piece, showing the changes occurring in the spirogyra majuscula when it dies and decays from nature's own cause.

FIG. 3.



Spirogyra majuscula as seen in normal condition by the aid of the magnifying power of a No. 8 Leitz objective and a No. 4 eye-piece.

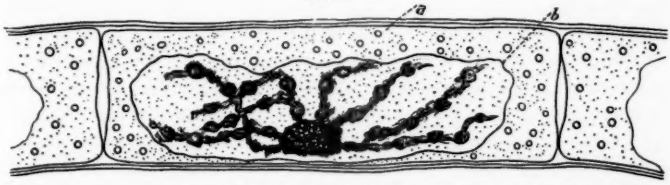
granules. The cell protoplasm is somewhat granular, and the protoplasmic streaming can be distinctly seen with a high magnifying power. The form of the nucleus varies with the species; in the spirogyra majuscula, the most suitable for this work, the nucleus is irregular in outline, being suspended in the central protoplasmic mass from which radiate protoplasmic threads; it has a nucleus and is slightly granular; in other varieties the nucleus is oval and has the appearance of a biconvex lens.

The spirogyra can be easily cultivated in the ordinary hydrant water. Care should be taken that the water be allowed to flow for some minutes

before using, to avoid that water which has been standing in the metal pipes (usually copper or lead), that contains poisonous metals which will destroy the spirogyra.

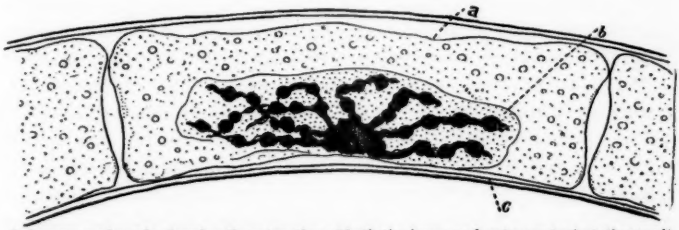
Carl von Naegeli described in a paper published some years ago (*Ueber die Oligodynamischen Erscheinungen an lebenden Zellen*[1]) a

FIG. 4.



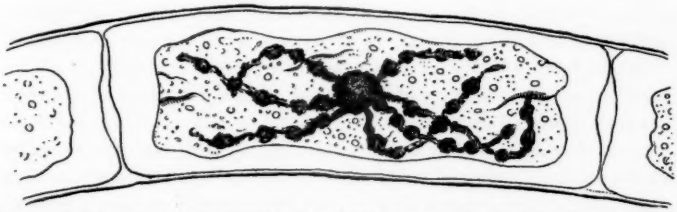
The same specimen as shown in Fig. 3 after treating it with toxic blood obtained from a patient suffering from so-called idiopathic epilepsy. *a*. Outer protoplast intact. *b*. Inner protoplast retracted.

FIG. 5.



Spirogyra majuscula showing the retraction of both the inner and outer protoplast, the result of continuous action of toxic blood diluted with 100 parts of water. *a*. Outer protoplast. *b*. Inner protoplast. *c*. Cell wall.

FIG. 6.



Spirogyra majuscula, showing retraction of the whole cell-contents, produced by the action of a 20 per cent. solution of sodium chloride.

variety of changes occurring in the spirogyra by treating the algæ with toxic substances, and distinguished three different special forms.

The first he found to be identical with those changes occurring in the cells when they die and decay from nature's own cause, especially those

[1] Neue Denkschriften der allgemeinen schweizerischen Gesellsch. für die ges. Naturwissensch. Band xxxiii., Abth. 1.

of in-door cultivation; the whole contents of the cell with the protoplasmic tube retracts slightly from the cell wall; the chlorophyl bands change in color and form without changing their relation to each other; the protoplasm becomes cloudy and granular; the nucleus, formerly oval and situated in the centre of the cell, takes on a rounded form and moves toward the periphery; this was brought about by treating the spirogyra with a weak alkaline solution of silver nitrate ($1AgNo_3$, $1NH_3$ and $3.6K_2O$ in 100,000 parts of water).

The second was the same as that caused by chemical reaction; the chlorophyl bands retract from the protoplasmic tube; they become shorter and form clumps of chlorophyl; the nucleus falls to one side, and usually disappears. This may be produced by a more dilute solution of the same poison.

The third, a pathological condition, which Naegeli termed "Oligodynamischen Erscheinungen," produced by infinitesimal amounts of toxic substances, such as copper, silver, lead, zinc, and mercury. These changes consisted of a retraction of the chlorophyl bands, displacement and deformity of the nucleus, and later retraction of the protoplasmic cylinder.

For the sake of becoming familiar with the methods of Naegeli, and gathering information in regard to the different reactions, the author, in connection with O. Israel, of Berlin, repeated Naegeli's experiments with somewhat different results.[1] To reproduce the pathological changes which Naegeli described, the author used pure metal foil. This is preferable, because it can be easily cleaned and there is less danger of contamination with other substances. A piece of copper foil, about three inches by two, was placed in a quart of hydrant water and allowed to remain undisturbed for twenty-four to thirty six hours; at the same time another quart of water was drawn from the hydrant and placed beside that containing the copper to be used as a control. A small quantity of water was taken from each jar and placed into separate glass dishes or watch-crystals. Several threads of spirogyra were then placed into each dish; after a few moments the specimens were examined under the microscope (No. 7 Leitz objective). It was observed that those threads taken from the water which had been treated with the copper foil were markedly changed, while those taken from the other dish remained intact. It was noticed that in the copper treated specimen a division of the protoplasmic cylinder had taken place, the inner more delicate portion having retracted and with it the chlorophyl bands, while the outer thicker part retained its original position. If the action of the poison was allowed to continue the latter also

[1] Israel and Klingmann. Virchow's Archiv für pathologische Anatomie und Physiologie und für klinische Medicin, 1897, vol. cxlvii.

retracted, leaving the cell wall perfectly transparent. The different stages of this process may be observed by placing the specimen on a glass slide with a few drops of the copper water, covering it with a thin cover glass and applying a No. 7 Leitz objective. The first change that will be noticed is cessation of the protoplasmic streaming, the protoplasm becomes granular, and then follows the division of the cylinder with nuclear changes, and finally retraction of the outer portion of the tube and destruction of the chlorophyl bands.

In recent investigations the author has found that the same pathological conditions just described can be brought about by the action of various bacterial toxins and toxic blood-serum, while those changes mentioned under one and two as chemical and physiological reactions will occur when these delicate structures are treated with solutions of inorganic salts of varying strengths.

In studying the conditions of the blood, especially its toxicity in a great variety of cases, numbering one hundred and fifty, some very interesting changes were noted. About one-third of these were in perfect health, the other two-thirds were patients suffering from various disorders, such as epilepsy, neurasthenia, hysteria, hystero-epilepsy, catalepsy, chorea, acute melancholia and mania, septicæmia, pyæmia, pneumonia, syphilis, tuberculosis, erysipelas, typhoid fever, scarlet fever, diphtheria, measles and other specific infectious diseases, acute and chronic alcoholism, gout and rheumatism.

The toxic condition of the blood was frequently determined by animal experiments, which invariably resulted in convulsions and death of the animal when inoculated with one or two cubic centimetres of toxic blood. The test was then made with the spirogyra majuscula. A half to one cubic centimetre of blood is taken from the patient's finger by piercing it and collecting the blood with a small graduated pipette, which has been previously cleansed with glacial acetic acid and thoroughly washed out with hydrant water, and the excess of water remaining in the tube shaken out. The part from which the blood is to be taken must also be cleansed in the usual way. After the blood has been obtained it is diluted with twenty cubic centimetres of water and thoroughly mixed ; a few drops of the liquid are placed on a clean glass slide ; a thread of spirogyra is put into this, and is observed under the microscope with about a No. 3 Leitz objective. This is sufficient for the ordinary changes, but if the finer changes are to be studied a thin cover-glass is placed over the specimen and a No. 7 Leitz objective applied.

It is of first importance that all glass dishes, slides and covers are chemically clean ; the spirogyra must be handled with bone-tipped forceps, and must not come in contact with metals. The water which is used

for diluting the blood is tested by placing a few threads of spirogyra in a glass dish containing some of the water, and is allowed to stand for a few minutes; if the water is non-toxic the specimen remains unchanged. The time in which the change will occur varies directly with the amount of toxin present and the species of spirogyra used. In one case it was found that the reaction took place after diluting the blood with five litres of water. In this way it can be determined whether the toxicity of the blood has increased or diminished. It was repeatedly observed that in testing the blood of patients who were convalescing the time in which the reaction took place was greatly prolonged; in one case of diphtheria this was noticed after two injections of antitoxin. In all cases examined, except those suffering from acute and chronic alcoholism and gout and rheumatism, a division of the protoplast of the spirogyra took place; in the cases of alcoholism, rheumatism, and gout the reaction was not the same as that occurring in the other cases, but resembled that described by Naegeli under the second heading; the chlorophyl bands were retracted from the protoplasmic cylinder and changed their general arrangement, and the nucleus changed its position and form.

The blood of fifty persons in perfect health was repeatedly examined, with negative results. One cubic centimetre of blood was diluted with five cubic centimetres of water and placed in a small glass dish; a few threads of spirogyra majuscula were put into this and allowed to stand for several hours; after this a microscopical examination was made, which revealed that the spirogyra were still in normal condition, and that protoplasmic streaming was present and of normal rapidity; the nucleus retained its natural position and form—in fact, no change whatever could be detected with a high magnifying power. Several guinea-pigs were inoculated with blood-serum from these cases without the slightest disturbance, and at the present writing the animals are still living.

To study the action of toxic blood on animal protoplasm the author instituted another series of experiments, and for this purpose a very low class of protozoa was selected. The rhizopodæ are very suitable, on account of the nudity of the protoplasm, and very satisfactory results were obtained. The special forms used were the amœba, difflugia oblonga, hæmatococcus pluvialis, paramæzium bursaria, spirostumum ambiguum (Ehrbg), vorticella microstuma, and stylongchia mytilus. These were treated with toxic blood in the same manner as the spirogyra and invariably ended the experiment in the destruction of animal life; considering the great morphological difference in the well-protected plant cell and the practically nude animal protoplasm, the action of the toxin may be regarded as analogous.

Very interesting were the changes in the hæmatococcus when treated with toxic blood. At first the movements of the cilia became markedly slower and, in consequence, locomotion was retarded, and after a few minutes complete cessation of motion occurred; the cilia appeared shorter and thicker; the oval body became round and somewhat enlarged; the whole organism took on a uniformly green color, and its definite structure could no longer be recognized. In the case of the paramæcium all movement ceased after three minutes' action of toxic blood obtained from a patient suffering from catalepsy. With other forms the same general results were obtained.

In treating these organisms with normal blood no change was observed in their structure, and they remained active indefinitely.

To eliminate the possibility of an error in the method, or contamination of the water with other substances, all the experiments were carefully controlled by placing in a portion of the water which was employed for diluting the toxic blood a specimen of the material used for making the test, and after several hours or even days the specimens remained unaltered, while if the toxic blood was added a change occurred in from one to twenty minutes, according to the amount of toxin present.

Ordinary distilled water cannot be used for diluting the blood, and if used must be redistilled from glass retorts. The author has frequently found that distilled water obtained from chemical laboratories has a slight acid reaction, and will produce those changes of pure chemical action in the algæ.

In the course of the above experiments it was observed that the protozoa and algæ succumbed to the action of toxic blood of patients suffering from functional nervous disorders quite as rapidly as to that of specific infectious diseases. This is in accordance with the theory of auto-intoxication and may aid us in the treatment of the so-called functional disorders. What this poison may be we cannot at this time ascertain, but that it exists will not be denied. Considering the uniformity with which the reactions in the above experiments occurred, the small amount of toxin required to cause the change, and the easy application of the method, this may be regarded as a delicate, reliable, and practical test for toxic states of the blood.

THE ROLE OF THE ALLOXURIC BASES IN THE PRODUCTION OF THE CARDIO-VASCULAR CHANGES OF NEPHRITIS.

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member of the american chemical society, etc.

Hypertrophy of one or both ventricles, with or without dilatation, and increased arterial pressure are found in many cases of nephritis and in various lesions of the kidneys associated with destruction of parenchyma.

Of the theories promulgated in explanation of this phenomenon only two merit serious consideration, viz., the mechanical or physical theory created by Traube[1] and the intoxication or retention theory originated by Bright.[2]

Traube's mechanical theory is readily disproved. He postulates that two factors in nephritis cause increase of arterial pressure with resulting hypertrophic changes in the heart and bloodvessels, viz.: 1. The obliteration of numerous bloodvessels in the contracted kidney, parenchyma, or their compression by exudate in acute inflammation. 2. The increase of the quantity of fluid in the arteries as a result of the decreased abstraction of water by the reduced or diseased kidney parenchyma.

These premises are fallacious: First, because increased resistance in the renal arteries does not produce increased blood pressure, as has been conclusively demonstrated by Ludwig, who failed to obtain increased aortic pressure after ligation of both renal arteries. Second, because a diminished excretion of water with resulting plethora would not cause the aortic pressure to rise; experimental injections of physiological salt solution, causing an excess of fluid in the arteries, do not produce a rise of pressure, for the reason that the arteries equalize the blood pressure by their vasodilator mechanism. Third, because in that form of nephritis in which cardiac hypertrophy is most frequent, chronic (primary) interstitial nephritis, the excretion of water is not only not decreased, but, on the contrary, increased from the very beginning. Fourth, because the arteries are capable of getting rid of excessive water through other channels than the kidneys.

Bright's retention theory postulates that in nephritis certain excrementitious substances are poured into the circulation that by exercising either a direct cardio-excitory action cause hypertrophy of the heart, or by producing constriction of terminal arterioles and capillaries throw additional work on the heart muscle and thus cause enlargement.

For those inflammatory forms of nephritis in which the heart changes are manifestly secondary to the kidney lesions, where we have the sequence—diminished excretion of urine, increase in arterial pressure, hypertrophy of the heart—no other explanation than the one given by Bright seems possible. The one undetermined factor remains: the nature of the substance or substances that are capable of producing the increased arterial pressure.

In primary interstitial nephritis (syn.: primary contracted kidney, granular atrophy of the kidneys, primary indurative sclerotic kidney, "gouty" kidney, lead kidney, "primäre genuine Schrumpfniere," etc.), however, in which hypertrophy of the left ventricle is found in from 50 to 90 per cent., retention of excrementitious substances does not occur except in the last stages. The cause of the cardiac hypertrophy must here be sought for outside of the kidneys.

Of the substances that are normally excreted by the kidneys and that in disease of these organs are retained, urea is the only one that has been physiologically tested for its effects upon arterial pressure, the arterial coats, and the heart. Ustimovitsch,[3] Grützner,[4] von Cavazzani and Robustello[5] injected urea into the blood and observed arterial spasm and a rise of blood pressure. O. Israel[6] fed rabbits with increasing doses of urea and produced both "hypertrophy of the heart and of the kidneys."

While investigating the rôle of uric acid and its congeners, the alloxuric bases, in the causation of so-called uric acid lesions ("Uric Acid Theories," etc.,* "An Investigation into the Causes of So-called Uric Acid Lesions," etc.†), a series of physiological tests were carried on with the latter group of excrementitious substances. It was found that they are capable of producing, first, marked anatomic changes in the kidney parenchyma, consisting in granular and fatty degeneration of the epithelial cells lining the tubuli contorti; second, a proliferation of the endothelial cells lining the intertubular capillaries. Gaucher,[7] in his investigations on toxic nephritis, had chronicled similar findings ("néphrite épitheliale"). Kolisch and Tandler[8] repeated his experiments and corroborated them ("Granular Atrophy").

The production of an endarteritis in the renal arterioles by the alloxuric bases led us to investigate the effect of these substances on the systemic bloodvessels, the heart and the arterial pressure, with a view of determining what, if any, rôle these excrementitious bodies played in the causation of the cardio-vascular changes so frequently observed in nephritis.

* Journal of American Medical Association, July, 1899.
† New York Medical Journal, August, 1900.

The alloxuric bases are, in contradistinction to uric acid and urea, very readily soluble in the tissue fluids, and possess highly toxic properties. They are found in normal urine in appreciable quantities —up to 0.06 gr. in twenty-four hours—and their formation and excretion or retention are greatly increased in a variety of morbid conditions. Their chief representatives are xanthin, hypoxanthin, adenin, and guanin.

Ten rabbits were subjected to daily hypodermatic injections of 1 c.c. of watery, slightly alkaline solutions of xanthin and hypoxanthin (the most readily procurable of the alloxuric bases), in concentrations of from 0.05 to 0.5 per cent. for xanthin and from 0.2 to 0.7 per cent. for hypoxanthin for different periods of time. In all rabbits the typical nephritis was produced, varying in intensity with the strength of the injections and the length of time during which they were administered.

Albumin appeared in the urine in from five to forty-two days. As the nephritic changes have been fully discussed in two previous publications mentioned above, their occurrence is herewith simply chronicled.

The following lesions of the cardio-vascular system were observed :

1. The Arterial Pressure. In the carotid of the rabbit the blood pressure is normally capable of supporting a column of mercury of from 60 to 90 mm. in height.

Animals I. and II.—In two rabbits of our series the carotid pressure was determined immediately after the first injection of 1 c.c. of a 0.3 per cent. and of a 0.5 per cent. solution of xanthin. In the first instance the manometer registered 104 mm., in the second instance 109 mm.

Animals III. and IV.—Two rabbits received injections of xanthin solution of 0.3 per cent. for six weeks. The manometric determination was made on the forty-second day, and twelve hours after the last injection the manometer registered from 107 to 108 mm. in one animal, and 109 mm. in the other.

2. The Arteries. Endarteritic changes corresponding to those found in the intertubular arterioles of the kidneys—*i. e.*, simple proliferation of the endothelium—were discovered in Animals III. to VIII.

In Animals IX. and X., where comparatively small doses of xanthin and hypoxanthin were administered for a long time, truly atheromatous changes were seen, consisting in small-celled infiltration of the intima and adventitia, with thickening of the intima and the appearance of necrotic tissue in different areas of the vessel walls. The muscularis, by comparison with the muscularis of two normal rabbits killed for control, appeared slightly hypertrophic.

3. THE HEART. Eight of the rabbits were subjected to injections of xanthin and hypoxanthin for a period of from forty-two to one hundred and ten days. In all these animals cardiac changes were determinable.

Animals III. and IV.—Two were killed at the expiration of forty-two days. In these, as stated above, the blood pressure supported 107 to 109 mm. of mercury. Nutrition was good, the animals were not emaciated. A concentric hypertrophy of the left ventricle was found. The right heart, the endocardium, pericardium, and myocardium were normal.

Animals V., VI. and VII.—Three rabbits were killed at the expiration of fifty-two, seventy-one, and eighty-nine days respectively. Daily injections of 1 c.c. of a 0.7 per cent. solution of hypoxanthin. In two (seventy-one and eighty-nine days) emaciation was extreme, and they were moribund when destroyed. In these hypertrophy and dilatation of the left ventricle and dilatation of the right ventricle were found. The myocardium showed degenerative changes. The third animal (fifty-two days) showed hypertrophy and dilatation of the left ventricle and no changes in the right heart nor in the myocardium.

Animal VIII.—One rabbit suffered daily injections of 1 c.c. of a 0.7 per cent. solution of hypoxanthin. On the fifty-fifth day the animal fell acutely sick, and died on the sixtieth day. Autopsy revealed sepsis. The left ventricle was hypertrophied and dilated.

Animal IX.—One rabbit was killed on the one hundred and tenth day. Daily injections of 1 c.c. of a 0.2 per cent. solution of hypoxanthin. Simply hypertrophy of left ventricle.

Animal X.—For a period of six months (one hundred and eighty-two days) received 1 c.c. of a 0.5 per cent. solution of xanthin twice daily. When killed was apparently in good health and well nourished. The heart, however, was greatly enlarged in all diameters. Both left and right ventricles were hypertrophied. No dilatation could be positively determined. Endocardium, pericardium, and myocardium were sound.

From these experiments we draw the following conclusions: Xanthin and hypoxanthin are capable of producing a rise in arterial pressure which may be due to arterial spasm, increased heart action, or both.

In view of the presence of endarteritic changes in the arteries and the absence of corresponding changes in the endocardium, we are inclined to the hypothesis that the primary effect of the alloxuric bases is exercised on the arteries, causing spasm. As a result increased work is thrown upon the heart, causing primarily hypertrophy of the left ventricle.

As long as nutrition remains good—*i. e*, as long as the intoxication is not so violent or so long lasting as to produce degenerative changes of the heart muscle—no dilatation supervenes. *Per contra*, owing to the increased determination of blood to the coronary arteries

(as a sequence of the hypertrophy of the left ventricle), the nutrition of the whole heart is ameliorated and the right ventricle hypertrophies. This hypertrophy of the right ventricle might be explained in a different manner—*i. e.*, as a result of spasm of arterioles of the pulmonary circulation. We know, however, that the pulmonary vessels do not respond to stimuli as vigorously as the systemic arterioles (Senator[9]), so that the latter explanation is not sufficiently grounded in fact. As soon as the nutrition of the heart grows defective, dilatation of one or the other or of both ventricles occurs.

Xanthin and hypoxanthin, therefore, representative members of the group of alloxuric bases, are capable of producing the cardio-vascular changes in those forms of nephritis in which retention of excrementitious substances *precedes* the lesions of the heart and arteries.

In the production of the hypertrophy of the heart so frequently seen in the primary interstitial form of nephritis, where the retention theory does not hold good, they also play an important rôle in a slightly different sense.

The three chief causes for this primary form of indurative sclerosis of the kidneys are (1) the so-called uric acid diathesis (gout); (2) lead, and (3) arterio-sclerosis. The rôle of syphilis, alcohol, and of diabetes mellitus is not universally recognized.

1. The Gouty Form of Interstitial Nephritis. In our previous publications on the rôle of the alloxuric bases in the production of so-called uric acid lesions we have demonstrated, we believe conclusively, that the alloxuric bases are the primary factor in the causation of "gouty" kidney and of the majority of the symptoms of the gouty diathesis. In the gouty form of primary interstitial nephritis, therefore, the same poison that produces the kidney lesion causes the cardio-vascular changes.

2. The "Lead" Form of Interstitial Nephritis. Lead intoxication can produce both the typical nephritis and in very chronic cases other symptoms of gout, so-called spurious or lead gout. We must conclude, therefore, that the toxic action of lead is either identical to that of the alloxuric bases or that lead is capable of causing metabolic changes in the organism which lead to the formation of alloxuric bases. These in their turn, as above, cause cardio-vascular, nephritic and gouty symptoms. Certain changes in the blood, "lead chlorosis," characterized by evidences of deficient oxygenation and of excessive nuclein katabolism, important factors in the generation of the alloxuric bases, lead us to favor the latter supposition.

3. The Arterio-sclerotic Form of Interstitial Nephritis. The inter-relationship between arterio-sclerosis and induration of the kidneys may be threefold, viz.:

(*a*) Arterio-sclerosis may be primary, the induration and atrophy of the kidneys secondary; "true sclerosis of the kidneys."

(*b*) As a result of parenchymatous nephritis with retention of excrementitious substances, both hypertrophy of the heart and arterio-sclerotic changes in the arteries may occur. In this case the nephritis is primary, the "arterio-sclerosis" secondary.

(*c*) The same toxins may simultaneously produce both the nephritis and the arterio-sclerosis (lead, gout, etc.).

Arterio-sclerosis is, therefore, only in isolated instances the cause of the nephritis. In the majority of instances, where the two conditions are found together, the arterio-sclerosis stands in no causal relationship to the nephritis, but is either a result or a concomitant feature. Where arterio-sclerosis is primary it usually constitutes a senile change. In all other forms it will be found that some kidney lesion coexists and that we are dealing with one of the forms described under (*b*) and (*c*).

Our investigations, therefore, justify us in attributing to the alloxuric bases an important rôle in the production of the cardio-vascular changes observed in *all* forms of nephritis with the exception of that chronic indurative form sometimes seen as a result of senile arterio-sclerosis.

A series of investigations, finally, instituted with varying doses of uric acid for different periods of time (see previous publication, Experiments I. to VIII.), revealed that uric acid is altogether without effect on the blood pressure, the arteries, and the heart.

References.

1. R. Bright. Guy's Hospital Reports, 1836, vol. i. p. 396.
2. Traube. Ueber den Zusammanhang von Herz und Nieren Krankheiten. Berlin, Hirschwald, 1856.
Traube. Nachträgliche Bemerkungen über den Zusammenhang von Herz und Nieren Krankheiten. Deutsche Klinik, 1859, Nos. 31 and 32.
3. Ustimovitsch. Arbeiten der physiol. Anstalt zu Leipzig, 1871, p. 198. Sächsische Gesellschaft der Wissenschaften, 1870, p. 430.
4. Grützner. Pflüger's Archiv der Physiologie, 1875, xi. p. 350.
5. Cavazzani und Robustello. Archivo per le Scienze med., xv. p. 329, and xvi. p. 425.
6. Israel. Virchow's Archiv, 1881, lxxxvi. p. 299.
7. Gaucher. Revue de Méd., 1888. Pathogénie de Néphrite, Thèse, Paris, 1886.
8. Kolisch und Tandler. Monograph, Stuttgart, 1895.
9. Senator. Die Erkrankungen der Nieren (Wien, Alfred Hölder, 1895), p. 98.

REVIEWS.

THE PRACTICE OF MEDICINE. A TEXT-BOOK FOR PRACTITIONERS AND STUDENTS, WITH SPECIAL REFERENCE TO DIAGNOSIS AND TREATMENT. By JAMES TYSON, M.D., Professor of Medicine in the University of Pennsylvania, etc. Second edition. Philadelphia: P. Blakiston's Son & Co.

COMING from a man of large experience, and bearing evidence of careful and conscientious preparation, well arranged, thoroughly practical, and up to date, it was only natural that the first edition of Dr. Tyson's work should have received a warm welcome from teachers, practitioners, and students.

This is in good faith a new edition. Buyers of books in this country are beginning to be a little shy and suspicious of so-called new editions. Three or four thousand copies of a work are exhausted in the course of a year or two, and the publisher calls upon the author to prepare what is termed a new edition. It is put upon the market, and one finds here and there a line or two of new matter, and the typographical errors corrected. We had occasion some years ago in reviewing Loomis' *Practice of Medicine* to call attention to this pernicious practice, to which authors should not lend themselves. In a *bona fide* new edition the articles should be really revised and in part rewritten, and important new matter should be incorporated. This edition of Dr. Tyson's work is of the right kind. A good deal of space has been gained by putting the historical matter in small type; this, by the way, is a very interesting feature of the book, as some of the sections are unusually well done, as, for instance, the note on appendicitis, which is exceptionally full and clear.

In the article upon typhoid fever we find much new matter, and the picture of the disease is well drawn and faithful to nature. We miss a reference to the valuable lessons of the Spanish-American war. The recent investigations upon the typhoid bacilli in the urine and in the gall-bladder are fully considered. The section on treatment is admirable. Dr. Tyson is conservative in the matter of diet, and while he quotes at length Dr. F. C. Shattuck's diet list, which is unusually liberal, he is, we think, safe in refusing to allow during the febrile stage such articles as minced meat, scraped beef, or soft toast. Hydrotherapy is advocated, either the full tub or the pack or the cold sponging. While he deals with the question of laparotomy in perforation, and advocates it early, the signs of perforation, which are so notoriously uncertain, deserve a fuller consideration. While a strong advocate of the tub, Dr. Tyson gives full consideration to the antiseptic and eliminative methods of treatment. In dealing with the specific treatment by the cultures, the work was probably too far advanced to give the results of preventive inoculation obtained by Wright in South Africa.

Dr. Tyson evidently considers that the mosquito theory is rapidly gaining evidence sufficient to warrant its acceptance. We need a much fuller study of the clinical features of the remittent fevers of this country, particularly with frequent observations on the temperature and simultaneous blood study by men who are really experts. Marchiafava and Bignami's article in the *Twentieth Century Practice* helps in part to clear up the confusion, and will be a very great help to students of the disease. There is a very good section in Tyson's work on the malarial hæmaturia, and he takes the ground that quinine cannot be held to be responsible, remarking that had he hæmoglobinuria he would prefer to be treated by quinine.

Turning to the important subject of yellow fever, Sanarelli's claim is discussed, and the only conclusion at present possible is arrived at that the etiological question is by no means settled. It is to be hoped that the work of the new commission in Cuba and of the Liverpool Tropical School Commission in Brazil will settle finally the question of the bacillus icteroides. The article is much extended.

In the article on measles there is a beautiful plate illustrating Koplik's sign.

The authors of text-books are, as a rule, busy practitioners, and we know some of them who have not even time to read the journals; still, they should feel in a measure bound to keep *au courant* with the progress of a disease in their own country. It would have added very much to the interest of the article on smallpox if Dr. Tyson had referred to the really very remarkable epidemic that has been prevailing throughout the United States during the past two or three years. It had a number of very strange features—so strange, indeed, that there were good practitioners who denied that it was variola.

The question of lumbar puncture is carefully considered in cerebrospinal fever, with an excellent chart illustrating the procedure. It is advocated, also, as a therapeutic measure. In the consideration of this disease all the new points are very well discussed.

There is a good account under dysentery of the recent studies of Shiga and Flexner upon the bacillus dysenteriæ.

The article on the bubonic plague is much extended, and full directions are given for the use of Haffkine's prophylactic.

This edition contains a new section upon the gonorrhœal infection, which has important medical relations.

A good change is the consideration of tuberculosis as a unit under the infectious diseases. It gives the student a much better conception of the whole process of the disease to take it up in this comprehensive manner.

The subject of pneumonia is transferred from the section on diseases of the lungs to the section on infectious diseases.

To one or two other prominent diseases we may refer.

In the first edition the subject of appendicitis was treated with clearness and with judgment. Living in a town in which the diagnosis of appendicitis is very often made by telephone, and in which the surgeons apparently have a monopoly in the right iliac fossa, Dr. Tyson has not perhaps appreciated that the pendulum has been swinging a little toward conservatism, and that we are beginning to realize that the disease does not require operation in every case. Still his position, as stated in a new paragraph, is admirably put: "The diagnosis being

thoroughly established, operative treatment should be deferred only long enough to determine whether symptoms will subside under rest. If they do not subside, operate at once. If they subside in a degree without disappearing, also operate. If they subside completely in twenty-four to forty-eight hours, do not operate until recurrence, then operate at once."

Under diseases of the gall-bladder a section on acute cholecystitis would have helped to call the attention of surgeons and practitioners to a condition by no means infrequent, and which, as Maurice Richardson has taught us, is very apt to be overlooked.

In section 5, preceding the consideration of diseases of the blood, there is a very full account of the minute structure of the blood, occupying nearly four pages. Except, perhaps, for the general practitioner who likes to have a text-book of medicine a sort of cyclopædia, this seems hardly necessary; certainly, it is superfluous for the student. Under pernicious anæmia there are two new cuts illustrating the iron pigment in the liver.

Dr. Tyson has been so long recognized as an authority on diseases of the kidneys that we naturally expect this section to be of special weight. He has altered slightly the arrangement of the subject of albuminuria, and has added several pages on renal dropsy, uræmia, and tube-casts. The division of the important diseases of the kidneys into acute parenchymatous, chronic parenchymatous, and interstitial nephritis remains as in the first edition. On the subject of renal stone he lays stress on the aid to diagnosis of the X-rays.

In the revision of diseases of the nervous system, Dr. Tyson has fortunately had the co-operation of Dr. William G. Spiller, than whom the profession possesses in this country no better student of the subject. Turning to locomotor ataxia, from which, perhaps, better than from any other disease one can learn an author's stand-point in nervous diseases, we notice that the good old name has been replaced, and we think correctly, too, by tabes dorsalis; but the synonym *locomotor ataxia* is not given, and, strange to say, neither under A nor L does it occur in the index. This reminds one of Dr. Foe's well-known *Shortest Way with Dissenters;* if you wish to get rid of a word and to stop the use of it by students abolish it altogether, and do not use it yourself. There is not much change in the article, and one is a little disappointed at not finding a fuller discussion of the relation of the disease to syphilis and of its close relationship with general paresis. Under treatment some description of Fraenkel's movements might have been inserted. There is a new and good section on ataxic paraplegia. One misses any reference to the remarkable condition of myasthenia gravis. There are several fresh illustrations of the cortical speech areas. The cut of the circle of Willis and the description of the arteries are surely superfluous. In the discussion of the subjects of anæmia and hyperæmia Geigel's researches have apparently not been incorporated. But these are minor points, and do not mar in any way the great merits of the book as a thoroughly trustworthy guide for practitioners and students in the science and art of medicine.

Again P. Blakiston's Son & Co. have set the pace in the matter of typography. There is no text-book of medicine on the market of so attractive an appearance. E. Y. D.

LECONS DE CLINIQUE MÉDICALE. Par Le DR. J. VIRES, Professeur Agrégé a la Faculté de Médecine de Montpellier, Médecine de l'Hôpital Général, Chargé du Cours de Clinique des Maladies des Vieillards. Pp. vii. 245. Montpellier: Coulet et Fils, 1900.

LECTURES ON CLINICAL MEDICINE.

THE charm of printed lectures often outlives the lecturer. An accurate description of disease as it offers itself to the audience, fixed by the truthful delineation of the experienced and careful demonstrator, may serve, decades later, to assist in a new classification or to indicate a new therapy. To-day the lectures of Charcot, to which we listened many years ago, recall the vivid description, the earnest presentation, and the logical deductions of the great master, and reading and re-reading are always a source of pleasure and profit. The author with his extensive field, more especially in the diseases of old age, has given us an instructive account of Basedow's and of Parkinson's disease, facial paralysis, syphilitic myelopathies, myxœdema, and gastric crises as he has met with these diseases and syndromes. So far as he has gone—and no attempt has been made to cover more of the field by internal medicine than is indicated above—his lectures bear internal evidence of their actuality. While nothing of novelty can be claimed, yet in their presentation they show a high order of merit. Our Gallic colleagues are frequently open to the criticism that their published lectures are diffuse and abound in repetitions, but to these objections we can state that the volume before us is not open. If it is wanting in any particular, it is that therapy is not sufficiently prominent nor extended. The work shows wide reading and that of literature, not by his own speech, if the reference to Bryson's sign (p. 2) be a proof. At times we could wish for an expression of more pronounced personal opinion, for instance, as to the rôle of the thyroid in exophthalmic goitre. And we hardly think the writer has clearly in mind the relation of myxœdema to acromegaly (p. 185). A brief résumé on "Morbid Antagonism," by Salager, closes the volume. R. W. W.

INTERNATIONAL CLINICS. Edited by HENRY W. CATTELL, A.M., M.D., Director of the Ayer Clinical Laboratory of the Pennsylvania Hospital, with the collaboration of JOHN ASHHURST, JR., M.D., LL.D.; CHARLES H. REED, M.D., and JAMES T. WHITTAKER, M.D., LL.D. Tenth Series, vol. i., pp. xiii. 315; vol. ii., pp. x. 300. Philadelphia: J. B. Lippincott Company, 1900.

THE *International Clinics* have been so long before the medical world that comment or criticism may seem to be unnecessary. The reviewer might readily close his notice with the statement that they still maintain a high standard. But while this is true there comes also a feeling of congratulation that in so far as these represent actual lectures the standard of instruction is being gradually but slowly raised. And just so far as they present modern ideas these ideas are resting upon the more secure basis of exact science. Naturally the various lectures are of different degrees of excellence—the "articles especially prepared" do not belong to the title—but all possess some degree of interest. "The

Progress of Medicine during the Year 1899," which occupies more than one hundred pages, would better be left to the year-books. The seven pages devoted to the Philadelphia Hospital Formulary, which also contain therapeutic notes, seems hardly in place in this work. The prescriptions are scarcely examples of elegant prescribing, and the matter is chiefly interesting to those engaged in dispensary work. The paper on "Camp Management" is particularly commended; the one following upon "Typhoid Fever Among the Troops at Chickamauga in 1898" gives an excellent presentation of how matters should not be attended to, and revives history which cannot but be a source of mortification to all who are proud of American medicine. The responsibility for such terrible neglect has been fixed, but no official condemnation has followed. In Volume II. there is much to commend. The dreary catalogue of papers read before the American Medical Association at the 1900 meeting possesses but little interest save to those participating in the proceedings. Of notable improvements which directly affect medicine is the Kromskop, and the paper describing it should be read with appreciation. Taken as a whole, this volume is excellent. So far as these volumes adhere to the orignal plan they are worthy of commendation in that they present truthful pictures of diseases and their treatment. The brevity of most articles permits their being read at odd moments when serious and sustained study is impossible. Keeping this in view, the authors have rendered a real service to medicine, and deserve the recognition which their effects have hitherto received. The series bears internal evidence that the standard of teaching is still more satisfactory, and we predict continued and deserved success.

R. W. W.

Syphilitic Diseases of the Spinal Cord. By R. T. Williamson, M.D. Manchester: Skerratt & Hughes, 1899.

This book is scarcely more than a thesis. It is written in the ordinary text-book style, with a few references appended to each chapter. The author appears to be very fond of classifications. He gives the notes of a few cases that have not hitherto been reported, among others three cases of syphilitic meningitis, a case of acute syphilitic paraplegia, and one of gumma of the cord. There are a few noteworthy statements, particularly the following: "When the temperature sense is affected the patient may be unable to recognize the difference between hot and cold test-tubes." There is nothing strikingly original, but the subject is well handled. In the preface the author states that it was his intention "to present a more detailed account of spinal syphilis than is generally found in text-books or systems of medicine," and we believe he has succeeded in this. One of the most interesting features of the book is the description of a case in which the symptoms were those of almost complete paraplegia, from which the patient partially recovered. At the autopsy there was degeneration of the pyramidal tracts throughout the cord, but of the posterior columns only as far down as the junction of the cervical and dorsal regions. The author does not offer any explanation for this peculiar distribution, and apparently the posterior nerve roots were not examined.

J. S.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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On the Cause of Diabetes Mellitus.—WILLIAMSON (*The Practitioner*, July, 1900, p. 61), in an interesting article on the above subject, publishes some statistics on the etiology and pathological findings in diabetes mellitus, in which, however, little that is new is brought to light.

The writer draws special attention toward the conclusion of his paper, however, to the large number of cases of diabetes in which neither the previous history nor the results of the post-mortem examination throw any light on the causation of the disease. These cases occur most frequently in young persons, and to this particular group Naunyn has applied the term of "pure diabetes."

According to Williamson, two theories as to the actual cause of the diabetic condition in these cases are worthy of consideration:

(1) A number of writers have held that these cases of diabetes, without apparent pathological lesions, are due to hereditary and congenital defect of sugar metabolism. If this be the cause, Williamson asks why the disease does not more frequently arise in young persons under the age of twenty years.

(2) According to the second theory, this group of cases is due to the introduction of some unknown toxic substance into the system. Williamson thinks that this view has not received the attention it deserves. He raises the question whether many cases of diabetes may not be due to the absorption of some poison from the alimentary tract. In favor of this view are the cases which develop in young adults or in children, which run a rapidly fatal course, and in which the history and the post-mortem examination fail to reveal any satisfactory cause.

In this connection, also, reference is made to the possible infectious character of diabetes. There is now quite a large number of cases reported in

which both man and wife have suffered from the disease. The statistics of Betz, Hertzka, Lecorché, Schmitz, Seeger, Külz, and Senator give, when combined, a total of fifty-six instances in which both man and wife suffered from diabetes among 5159 diabetic patients—a little over 1 per cent. Williamson is rather skeptical as to the infectious character of the disease, and seems disposed to attribute the association of diabetes in man and wife rather to their being exposed to the same predisposing influences than to any specific infective agent.

Of great interest is the result of experimental work recently published by Leo. He found that when large quantities of diabetic urine were administered by the mouth or subcutaneously to dogs, that glycosuria was generally produced. The same results followed if the diabetic urine was freed from sugar by fermentation. Normal urine very rarely produced glycosuria when given in the same way. Leo concludes that diabetic urine contains a poison which produces glycosuria when introduced into the system. He thinks that the poison is possibly produced by the action of micro-organisms.

Töpfer showed that the injection of a quantity of the contents of the small intestine of a diabetic patient under the skin of a rabbit produced glycosuria. The intestinal contents of a healthy individual fails to produce the same result.

Töpfer also found that glycosuria could be produced in dogs by the injection into the stomach or small intestines of a portion of the intestinal contents of a diabetic patient. Negative results followed when the intestinal contents of a non-diabetic patient were used.

It would seem, then, that the intestinal contents of a diabetic patient possess the power of exciting glycosuria.

Lépine found that a temporary increase of the amount of sugar in the blood occurs after the injection of a culture of staphylococci into the jugular vein in dogs.

Williamson concludes that whereas these experiments on the intestinal and bacterial origin of diabetes require confirmation, yet they are extremely suggestive when one considers how many diabetics die without any definite etiological factors or post-mortem findings at autopsy.

Pseudochylous Ascites.—Michele and Mattirolo (*Wiener klinische Wochenschrift*, 1900, No. 3) have investigated the cause of the opacity of some cases of chylous ascites in which the fat present was not sufficient to explain the condition. The suggestion of several observers that some proteid body, globulin, seromucoid, casein, etc., might be the cause, the authors show to be undemonstrated. They were fortunate enough to have four cases to study, viz., one of adherent pericardium and cardiac thrombosis, one of pancreatic cancer with metastases in the peritoneum, one of secondary sarcoma of the spleen, and one of cirrhosis of the liver with chronic peritonitis.

The clinical histories are given in abstract, full reports being promised in another place; the results of examinations of the fluids are given in sufficient detail. All the cases showed milky ascites, and the case of hepatic cirrhosis had also milky fluid in the pleural cavities. Without chemical examination the opacity would have been ascribed to fat. It was not altered by filtration, nor by centrifugalization, and ether and caustic potash made

little changes. The ethereal extract of fats—cholesterin and lecithin—was never more than 1 per mille; whereas it requires at least 1.5 per mille of emulsified fat to make a fluid opalescent. The authors finally came to the conclusion that lecithin was the cause of the opacity, the source of the former being readily found in many cells and fluids of the body. By experiment they found that 0.15 gramme of lecithin sufficed to render 1000 c.c. of serous fluid distinctly opalescent. Such an amount was present in the fluids in all the authors' cases. The demonstration that lecithin is the cause of opacity in a fluid containing but little fat can be made by treating some of the fluid with four or five times its volume of alcohol, coagulating the albumin, and warming the mixture on a water-bath to 70° or 80° C., lecithin being soluble in warm alcohol. On evaporating the alcohol the opacity returns again. It still remains to show to what extent lecithin occurs in the true fatty effusions.

[It is hardly necessary to add that the subject is at present of no practical importance, since there is no relation between the milky exudate and any particular anatomical alteration. It seems, however, that in cases with chylous or fatty effusions the precise constituents should be worked out as fully as possible.—ED.]

Cysticercus in the Spinal Cord.—PICHLER (*Prager medicinische Wochenschrift*, 1900, No. 16) reports a case of this kind, only two others being known to him in the literature. The patient, a brickmaker, aged forty-eight years, had multiple cysticerci in the skin and brain, and was sick for one year, with epileptic attacks, dementia, and marasmus. There were no spinal symptoms. The cerebral meninges and the brain contained numerous cysticercus vesicles of various sizes and in different stages. The pons contained two small ones. The cord showed no alteration externally, but at the level of the eleventh dorsal vertebra there was a cysticercus in the posterior columns, and at the level of the first lumbar there was another in the right posterior quadrant of the cord. The upper vesicle had substituted the posterior columns, especialy the right, the posterior gray commissure, and the median part of the base of the posterior horn; the central canal was pushed forward and obliterated. Around the vesicle was the usual thick layer of connective tissue and a zone of small cell infiltration. The bloodvessels in the zone frequently contained hyaline thrombi. The lower vesicle occupied the position of the right posterior horn and a narrow zone of the right lateral column. The posterior horn was reduced to a few fibres in each side, and toward the posterior root, where the vesicle reached almost to the periphery of the cord, it had almost disappeared. The wall of this vesicle was thick in places; hyaline thrombi were relatively few, but the wall and its vicinity were much richer in small cells than in the other, showing either more rapid growth or an earlier stage. Above the upper vesicle there was ascending degeneration in the right column of Goll. The lower bladder had caused no such effect. The absence of spinal symptoms can be explained partly by the mental condition of the patient.

Traumatic Diabetes.—J. FRANK (*Prager medicinische Wochenschrift*, 1900, No. 25) reports an instructive case, illustrating incidentally the importance of examining the urine of all patients. A youth, aged nineteen years, had

coxitis from his fifth year, and received various kinds of treatment. In October, 1899, the deformity of the hip was corrected. A month later the plaster dressing was changed and the leg massaged. At this time the patient became much excited, lost his appetite, and acquired an unquenchable thirst. Examined a week later, the patient showed extreme loss of strength; the expression was that of an old man; the tongue dry, red, and fissured; the gums red. The urine had a specific gravity of 1050, and contained 6 per cent. of sugar. Notwithstanding careful dietetic treatment, the patient failed steadily and died four weeks after the shock. The author admits the possibility of a longer duration of the diabetes, with exacerbation from the fright of the dressing, and in the absence of an autopsy admits the possibility of other organic disease [*e. g.*, miliary tuberculosis].

Cancer of the Stomach, with Rapid Course.—Lissau (*Prager medicinische Wochenschrift*, 1900, No. 25) reports the case of a man, aged twenty-eight years, who for three weeks complained of severe pain in the sacral region, paroxysmal, and increased by motion. Aside from slight elevation of temperature and tenderness to the left of the first lumbar spine, physical examination was negative. There was improvement, so that the patient was discharged, but in three days complained of the same symptoms as before, with a feeling of pressure under the right costal margin, and loss of appetite. There was slight icterus, tenderness in the right hypochondrium and to the left of the lumbar vertebræ. In the next few days the icterus increased, the stools became clay colored; restlessness and emaciation were noted. By the end of the week there was severe icterus, with bloody stools, hæmatemesis, great prostration, and frequent pulse, and in two days more death ensued. The autopsy revealed cancer of the stomach, with metastases in the liver, pancreas, and lymph-glands, and compression of the common duct. Details of the size and position of the primary growth are not given.

Embolism of the Pulmonary Artery.—This lesion is so rarely recognized at the time it occurs that a case observed by Drasche (*Wiener klinische Wochenschrift*, 1900, No. 23) will be of interest. The patient, a woman, aged sixty-eight years, complained for several weeks of palpitation of the heart and dyspnœa, and a week before admission had taken to bed with swelling of the legs. The heart was somewhat enlarged, the sounds pure but dull, the pulse arhythmic, tension moderate, the walls not rigid. The liver was slightly enlarged; the urine scanty, with albumin, but no casts. Both legs were swollen, the superficial veins distended and sensitive to the touch. Repeated examinations of the heart revealed nothing more. Soon after the ward visit, one morning, the patient suddenly had an attack of suffocation, with rattling in the throat, cyanosis, convulsions, spasm of the facial muscles, rolling of the eyes, and loss of consciousness. These symptoms lasted only a few minutes, and the patient was examined immediately afterward. She was not aware of the attack, was still very much cyanosed and collapsed, with cold sweat, anxious expression, slow pupil reaction, the pulse hardly palpable, arhythmic, about 150. Over the heart, on the sternum, from the second to the third interspace, was a strong, diffuse, systolic thrill. In the same area a long, rough, peculiarly eddying murmur

was audible—systolic, but also prolonged into diastolic, and sometimes apparently double. Severe dyspnœa made accurate observation of this sign difficult. It suddenly disappeared, along with the thrill, and only the dull, uncertain sounds could be heard. Two hours later the patient felt better, complained only of great weakness, was cyanotic, but not dyspnœic. The heart was irregular; pulse 120, small and weak. Near midnight, fifteen hours after the first attack, another came on, and before the physician reached her the patient was dead. Autopsy showed hemorrhagic infarctions of the lungs, dark red clots in some branches of the pulmonary artery; the right ventricle slightly dilated; mitral valve thickened, but competent; the other valves normal. A thrombus, 4 cm. long and 3 cm. in circumference, filled the main pulmonary artery and obstructed the right branch. In the left branch a tangled thrombus, 1.5 cm. in circumference, completely obstructed the sub-branches. The right iliac vein was filled with a dark red clot, extending into the cava. The right iliac and femoral contained dark-red, slightly adherent clots, containing a firmer, worm-like thrombus, like that in the left pulmonary artery. According to the autopsy, the left pulmonary artery became obstructed first, the clot causing a temporary obstruction as it passed through the right venous ostium. The thrombus in the right branch was so large as to cause death immediately. Although the recognition of the true state of affairs was to a certain extent accidental, the observation is of value in a diagnostic way.

Changes in the Urine after Palpation of the Kidneys.—MENGE (*Münchener medicinische Wochenschrift*, 1900, No. 23) was struck by finding transitory albuminuria in two patients with movable kidneys, after diagnostic palpation. This led him to make careful observations of the urine before and after manipulation on twenty-one patients. Often, though not always, albumin was found in the urine, varying greatly in different cases. In six cases there was no alteration; in fifteen there was albumin up to 0.5 per mille (Esbach). In all cases the albumin disappeared within twenty-four hours, once in three-quarters of an hour. The idea that the albumin depended on a hæmaturia was confirmed in five cases, though the albumin was always more than could be explained by the blood present. In two cases there was also cubical epithelium. Examinations of the bladder with the cystoscope showed that the blood did not come from mechanical lesions of the bladder, and catheterization of the two ureters showed that the abnormal elements came only from the palpated kidney. In one case palpation of both kidneys in turn showed an increase of albumin (estimated) after the second palpation. The author concludes, though with some hesitation on account of the small number of observations, that the appearance and quantity of blood and albumin after renal palpation depend on the force and duration of the palpation, the nutrition of the patient, the tension of the abdominal wall, and the degree of nephroptosis, and also on the "sensitiveness of the palpated organ." He adds some considerations concerning renal pathology that need not be referred to, but makes two therapeutic suggestions that deserve some notice. On the ground of his observations he advises against the massage of the renal region and the use of bandages in nephroptosis. Regarding these points further observations would seem indicated.

SURGERY.

UNDER THE CHARGE OF

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Suprapubic Lithotomy in Old Men with Enlarged Prostates.—THOMAS (*Lancet*, June 9, 1900), in speaking of the post-prostatic pouch so frequently found in cases of enlarged prostate, says that it is frequently the seat of calculus formation, and that calculi may remain in such pouches for months without causing cystitis or notable symptoms. The symptoms in some of his cases have been so slightly different from those of enlargement of the prostate that the existence of the calculi could have been, and most often has been, overlooked. Slightly increased frequency of micturition and occasional pain may attract attention; in one case a little blood was noticed in the urine on one occasion. Catheter life will generally lead to cystitis, with increased pain and some blood from the rough phosphates that collect on the surface of the calculus. When in cases of enlarged prostate with any degree of residual urine the symptoms become in any way exaggerated it is well as a routine practice to sound for stone, and if the prostate be very large to use a special sound (Kane's) or the cystoscope to explore the pouch behind the middle lobe. These calculi often escape the ordinary sound or aspiration sounding. The strictest antisepsis in the washing out of the urethra and bladder should precede all these examinations.

Of the choice of operation Thomas says: "The objections to crushing in these cases are: (1) The difficulty, or even the impossibility, of seizing the calculus; (2) if caught and broken, then the difficulty in finding the fragments; and (3) granted the possibility of crushing, then aspiration, diffusing the fragments into innumerable bits in the mucous membrane, the great uncertainty of washing out all the pieces, for in these cases the patient cannot be trusted to pass any portions left behind; they will lodge behind the prostatic enlargement and form nuclei for fresh calculi."

The difficulty of seizing the calculus was illustrated by some of the author's cases and by the statistics of lithotrities, which show how often recrushing has to be done because the fragments were not all washed out and new calculi form. "Perineal lithotomy is not applicable, owing to the great increase in the depth of the perineum, to such an extent in some cases that neither finger nor forceps can reach the stone. The suprapubic operation, carried out with modern precautions, is simple and almost bloodless; it enables the bladder to be thoroughly explored and allows of the extraction of the cal-

culus and of treatment of the enlarged lobe if thought advisable. It becomes the procedure of choice in the cases under consideration. Further, the bladder can be sutured and the wound treated antiseptically.

"Before resorting to operation it is advisable to render the urine and urinary tract as sterile as possible If cystitis with ammoniacal urine be present, the administration of urotropine in five-grain doses thrice daily, and washing out the bladder with chinosol lotion (1: 1200) twice a day or oftener, have answered best in my experience. Boric acid is much too feeble an antiseptic if the urine be 'high.' Chinosol is non-poisonous and a powerful antiseptic. It is imperative that every aseptic and antiseptic precaution should be taken in urethral and bladder surgery; to do so means absence of rigors and complications. There is an idea prevalent that any catheter from an old drawer or hand-bag smeared with that abomination carbolic oil will do. The catheter should be boiled or steamed, the glans penis should be thoroughly cleansed with chinosol lotion, and the urethra should be washed out with the same. The lubricant used is a mixture of soft soap, glycerin, and water in proportions of eight, six, and four. Four grains of potassium mercuric iodide dissolved in four ounces of water before mixing makes a proportion, in the lubricant soap, of 1 : 2000. In ordinary cases, without ammoniacal urine, the administration of urotropine is enough. It is useful in all bladder, urethra, and kidney cases that require surgical treatment to administer urotropine internally for a few days before operation —that is, of course, if the condition does not urgently demand operative procedures."

External Urethrotomy.—HARRISON (*Lancet*, March 17, 1900) says that this operation seems especially applicable to the following cases: 1. To resilient and rapidly contractile strictures in the deep urethra, which, like burn scars, are unamenable to stretching and dilatation, and where a splice or an interval of new tissue is required within the circumference of the contraction.

2. In cases where the wound made by an internal urethrotomy is out of proportion to the drainage possibilities of the urethra. A wound may be so constructed within this canal as never to drain completely, either in regard to urine or to its own discharges. The result is much the same in these cases as that which follows accidental lacerations of the urethra. Some years ago the author demonstrated in a considerable number of cases that partial ruptures of the urethra from violence, when treated properly by perineal section and drainage, were no more liable to be followed by traumatic strictures than either a median or lateral cystotomy for stone. This was suspected because it was noticed that the slighter cases of ruptured urethra, either not treated or treated by the retention catheter, were those which were followed by the most dense and contractile forms of traumatic stricture; whereas the severe cases, where the rupture was so extensive and so complete as to render the introduction of the latter instrument impossible and to necessitate a perineal section with bladder drainage, did the best, and were much less liable to the subsequent formation of a stricture at the site of the wound. Surgical cleanliness and drainage were evidently important items in the prevention of the latter. In dealing with any lesion of the urethra,

made either accidentally or surgically, we must feel fairly sure that the unaided efforts of the wounded canal are sufficient to furnish adequate drainage, otherwise this should be artificially supplied. It is reasonable to infer from these observations that in the large proportion of cases where internal urethrotomy gives excellent results the operation precisely fulfils the required condition—namely, the complete division of the stricture by a wound which the urethra itself is capable of draining. It is no doubt possible in some instances where considerable wounds are made within the urethra to supply the drainage by the retention of a catheter for some days after the operation. This expedient often fails, as in the case of accidental injuries, and is not so reliable or cleanly as the external incision and the drainage-tube.

3. In cases of stricture complicated by urinary fistula and sinuses. The division of the stricture from without and the formation of a single opening for urine drainage communicating directly with the bladder often lead to a speedy recovery in these instances.

4. In cases of stricture with extravasation of urine. The division of the former, with direct drainage of the urine from the bladder as well as from the surrounding tissue, is a matter for separate consideration.

5. In some rare cases of wounds connected with the treatment of stricture which are rapidly followed by acute symptoms of impending death, the rapid draining of the bladder prevents further absorption of toxins and saves the patient.

The points to which he attaches importance in operating are: (1) The use of a guide. (2) The utility of an internal urethrotomy as an immediate preliminary to the external operation is shown by the ease and completeness with which the latter can be carried out on a larger staff than could be otherwise used. (3) The necessity of cleanly and efficient urine and wound drainage. The entire character of the tissue by which the stricture is repaired after it has been divided either by external or internal urethrotomy may be determined by the nature and duration of the drainage and irrigation that is employed.

The Relationship between Cholecystitis, Jaundice, and Gallstones — MacLaren (*Annals of Surgery*, April, 1900) points to the fact that jaundice is not always a symptom of cholelithiasis. There can be no question that jaundice is a very much overrated symptom, nor that many patients pass through an attack of cholecystitis and later carry stones for years without any discoloration of either eyes or skin. Within a year the author has operated upon nine cases of gallstones, and in not one of these cases has there ever been any jaundice at all. The reason for this may be the fact that none of them has passed gallstones. He is inclined to believe that the passage of gallstones is rather an unusual occurrence; that when we speak of a patient as having biliary colic we are apt to believe that the colic is due to the passage of gallstones. The few cases cited would prove that this is not the fact, because in almost all of them, either through stricture or through wedging a stone in the cystic duct, the gall-bladder was shut off from the other biliary tracts. Still, all of these patients had suffered intense colic, and nearly all of them before operation had at different times to be relieved by morphine in large doses. All of these cases gave symptoms which are

usually ascribed to the passage of gallstones; in most of them the feces were washed and strained through a sieve without finding a single stone, and, further, the conditions found at the operation were such as to preclude the passage of a stone.

In all but one case the gall-bladder was found inflamed, thickened, and frequently adherent to the neighboring organs, in one case producing a mechanical dilatation of the stomach, through the influence of adhesions which existed between the gall-bladder and the pylorus, the conditions found to be present showing that the pain from which the patient had suffered was due to the cholecystitis, and not due to the passage of gallstones. Most of the chronically jaundiced cases have been found by the author to be malignant disease of the liver. The most pronounced jaundice seen was due to septic infection, and there was no biliary involvement. The impaction of stones in the common duct he has found to be of rare occurrence; they are much more frequent in the cystic duct, and can be generally removed with ease through the gall-bladder. In one case a faceted stone was discovered that had ulcerated its way out of the gall-bladder, and was found encysted in the under surface of the liver.

He thinks that inflammation of the gall-bladder is the first step in the majority of cases in the formation of gallstones, and that the gallstones are a secondary product of this inflammatory condition, being, therefore, a symptom rather than a disease.

There is apparently good evidence to show that gallstones are the result of bacterial infection. The bacteria enter the gall-bladder through the liver, which filters them out of the circulation; agglutinating in masses together with epithelial cells they provide the nuclei about which calculi form.

The Closure of Abdominal Wounds and Hernial Openings with Silver Wire.—WITZEL (*Centralblatt für Chirurgie*, March 10, 1900) calls attention to the value of silver wire in securing absolute closure of abdominal wounds and a guarantee against the occurrence or recurrence of herniæ.

Absolute asepsis is essential to the primary union of such wounds and the healing in of deep or permanent sutures. The suture which takes in the whole abdominal wall has been found to be unsatisfactory, and the best results are obtained by careful suturing of each separate layer by itself. It is particularly essential that the fibrous commissure of the rectus sheaths should be brought into exact coaptation. The formation of herniæ through scar-tissue is the result of the stretching and weakening of the scar by muscular action.

In employing silver wire in the closure of abdominal wounds he advises the suturing of the separate layers with silver wire and the placing of the stitches in such a manner that the sutures cross and recross each other over the wound, forming a sort of network, which strengthens the scar and prevents the stretching and separation of the muscular layers.

The network of wire which is placed over the hernial orifice should be at least three times as wide as the original opening. The interweaving or "darning" of the silver wire is very effectual in forming a plug in the closure of all herniæ.

PEDIATRICS.

UNDER THE CHARGE OF

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AND

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Typhoid Fever in an Infant of Nine Months.—W. P. NORTHRUP (*The Medical Age*, May 10, 1900, p. 331) reports a case which he states is the youngest undoubted case of typhoid fever in his experience. At the time of admission to the hospital under Dr. Northrup's care the father and two brothers of the baby were also patients in the hospital suffering from the same disease. The mother was not infected, and nursed the baby at her breast. The infant had been crawling about the bed of its father, sick in his second week, and of a brother, sick seven weeks, the latter the first of the family to be affected. Twelve days before admission a physician took the baby's temperature and told the mother that the baby had the "same sickness" as the father and brothers. For a week before this the passages were frequent and greenish. The temperature was 103° upon admission, the tongue coated, abdomen hard, distended, and tympanitic, the spleen distinctly palpable one and a half inch below the border of the ribs, the liver also enlarged slightly. Rose spots appeared six days after admission to the hospital. The passages continued frequent, soft, and containing mucus and greenish pultaceous masses for about ten days. By the nineteenth day of the disease the temperature began to fall, and the spleen was markedly reduced in size. From the time the family physician first took the temperature to the end of the fever in the hospital was twenty-four days.

The Widal test confirmed the diagnosis only after the temperature had returned to normal.

The feeding of this case is rather interesting. The mother came three times a day to the hospital and nursed the baby. Other feedings consisted of milk diluted with water and lime-water. This mixture seemed to disagree, as indicated by the passages. Modified milk was therefore substituted. The first prescription was: Fat, 2 per cent.; sugar, 5 per cent.; proteids, 0.75 per cent.; ten feedings of two ounces each, of 10 per cent. alkalinity, and Pasteurized at 155° for twenty minutes. This was fairly borne, and the proportions were increased to fat, 3 per cent.; sugar, 6 per cent., and proteids, 1 per cent., which was found to produce flatulence, with mucus and curds in the stools. The prescription was reduced to the former percentages for a few days, when the symptoms were relieved, and the prescription was again changed to the stronger combination. From this point the ingredients of the mixture were gradually increased to a 4-7-2 mixture.

[This case illustrates the point which Dr. Northrup has long maintained, that typhoid fever is a disease to which there is little susceptibility in

children under two years of age, except in the presence of an overwhelming poison (multiplied exposures), as was undoubtedly the condition in the case here recorded. It is only the sixth case which Dr. Northrup has observed in patients under two years of age.—ED.]

The Spleen in Rhachitis.—SASUCHIN (*Jahrbuch. f. Kinderheilkunde*, 1900, Band i. (n. s.), S. 297) bases this study upon an examination of the spleen in sixty-six cases of rhachitis in which death had been the result of the cachexia or of an intercurrent malady, most frequently a gastro-enteritis or bronchopneumonia.

Almost always the organ was hypertrophied, the exception being in cases in which athrepsia was advanced, and here the spleen in weight and size was close to the normal or even sometimes manifestly atrophied.

The histological lesions were those of interstitial splenitis. The proliferation of connective tissue ordinarily follows the vessels, whose walls are thickened and whose lumen is reduced. Inflammatory phenomena are shown by the appearance of irregular epithelioid cells with cloudy protoplasm and nuclei staining poorly.

This interstitial splenitis, according to the author, is produced by rhachitis, and cannot be attributed to the later complication, since it is observed in the most varied conditions, while it is entirely absent in non-rhachitic infants that have succumbed to the same complications.

The Palatine Tonsil as a Port of Entry for Tuberculous Infection in Young Children.—Believing that the tonsils are the primary seat of many infectious conditions, FRIEDMANN (*Deutsche medicinische Wochenschrift*, June 14, 1900) has made a study to determine whether the tonsil in childhood may not constitute a frequent port of entry for tuberculosis. The study embraced ninety-one post-mortem cases and fifty-four living subjects. He recognized that tuberculosis of the tonsil may exist either as a primary infection from food or as a secondary infection from sputum containing the bacilli. Contrary to Koch's opinion discrediting the influence of the milk or flesh of tuberculous animals in communicating the disease to man, the author is led to attach considerable importance to this possible method of infection, the more so as secondary infection of the tonsil from the sputum is a comparatively rare condition in childhood.

A Case of Recovery from Tuberculous Cerebro-spinal Meningitis—M. HENKEL (*München. medicinische Wochenschrift*, June 5, 1900) records a case of proven tuberculous cerebro-spinal meningitis in which recovery ensued. Tubercle bacilli were found in the cerebro-spinal fluid. The case ran a long and tedious course, but finally recovery ensued. Internally calomel was the only remedy given, with the addition of a daily bath for ten minutes at a temperature of 95° F., gradually reduced to 85°.

The Prevalence of Rickets in Russia.—STJELBITSKY (*Dietskaya meditsina*, February, 1900) presents a statistical study of the prevalence of rickets in the Tula district, which shows that in this section of Russia, at least, rhachitis is extremely common. Two thousand children were examined, 1000 of

whom were seen in dispensary, 874 among the peasantry, and 126 in private practice. Among the peasant class 77.5 per cent. were affected; among the dispensary cases, as might be expected, a somewhat higher proportion was found—83.8 per cent., while 60.3 per cent. were affected among the children seen in private practice. The age varied from three months to two years.

Bad hygiene of the surroundings did not seem to influence the occurrence of the disease to any appreciable degree; nor could the author show that there was any close connection between rickets and syphilis. Gastro-intestinal derangements seemed to play the most important rôle.

THERAPEUTICS.

UNDER THE CHARGE OF

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Olut Kombool in Dysmenorrhœa —Dr. B. M. Sircar recommends the fresh, viscid sap from the Abroma Augustum, of the natural order Bythneracea, which is a large, spreading shrub found in the non-tropical parts of India. The medicine [amount not stated] is used for two days before, during the flow, and for two days after the cessation of the menses. A single administration during the menses generally cures the disease and brings on conception in young married women. The remedy is efficacious in both the congestive and neuralgic forms of dysmenorrhœa, but it has no action upon the mechanical variety nor on organic lesions of the uterus. Forty years' experience with the remedy is the basis of the author's confidence.—*Indian Medical Gazette*, 1900, No. 5, p. 172.

The Physiological Properties of the Nitrites —M. Edmond Fiquet has been impressed with the fact that the group CO_2H, when substituted for H in an organic molecule, has the property of diminishing the toxicity of the primitive body. It has been demonstrated that hydration and oxidation which take place in a living molecule give rise to products of disassimilation, named leucomaïnes, and as when, in consequence of a partial arrest of hydration and oxidation, these are poorer in oxygen, they become more toxic and resemble ptomaïnes. If we introduce a carboxyl group the molecule becomes more oxygenated, and consequently less toxic. By the action of sodium cyanacetate or cyanacetic acid on benzylic aldehyde and oxybenzylic aldehyde various nitrites are formed. Acetic nitrite, however, is obtained from the distillation of cyanacetic acid. Acetonitrite, cyanacetic acid, cinnamic nitrite, and α-cyanacinnamic acid have been employed. These experiments resulted as follows: (1) Acetonitrite is much less toxic than is generally supposed; but in general the higher nitrites are very toxic, acting upon the organism as do ptomaïnes. They dilate the pupil, which, however, con-

tracts at death; they destroy sensibility and muscular contraction and produce marked paralyses, slowed and irregular respiration, and convulsions. These characters approach closely those produced by injection of human urine into rabbits, particularly if from patients suffering from certain neuroses. The suggestion is made that very toxic urines may contain a body possessing a nitrite function. (2) The influence of the CO_2H group considerably diminishes the toxic power of the nitrites without always destroying the inherent properties of the CH—that is to say, during the administration of these derivatives the symptoms of the cyanic group appear. The CO_2H group is not the only one which produces modifications; the SO_3H group behaves in an analogous manner.—*Les Nouveaux Remèdies*, 1900, No. 9, p. 193.

Epicarin in Dermatology.—Dr. Carl G. Pfeiffenberger has made use of this substance in pediatric practice, especially for scabies and prurigo. Noting the irritation produced by naphthol, the dangers of nicotine, and the unpleasant effects of styrax, he congratulates himself on the absence of untoward symptoms from fifty instances of the use of this substance. This occurs as a reddish powder of sour odor, and is a condensation product of cresotinic acid and naphthol. It is acid, and dissolves readily in alcohol, ether, and vaseline; in the latter a 7 per cent. solution is employed. Inunction is practised once daily (in the evening) and the following day a warm bath is given. Finally the cure is completed by diachylon or zinc ointment. The following is presented as an eligible form of administration: Epicarin, 7; chalk, 2; white vaseline, 30; lanolin, 15; lard, 45.—*Klinische-therapeutische Wochenschrift*, 1900, No. 19, S. 586.

Treatment of Typhoid Fever.—Dr. Frank Billings believes better results are obtained from hygienic than from drug treatment. General management: Select a room free from hangings and upholstery, preferably carpetless, sunny, near a water-closet which may be wholly under the nurse's control. Thorough cleanliness is essential. Soiled garments and bedlinen are best disinfected by immersion in corrosive sublimate (1 : 1000); the same solution may be used on the patient's skin. Feces and urine contain the bacilli and are the usual media of contamination of soil and drinking-water. Both should be thoroughly disinfected. An efficient nurse can prevent dry, cracked lips, dirty tongue, sordes, and bed-sores. Milk is the best diet. It may be modified by dilution with lime-water, Vichy, or other mineral waters, or it may be boiled or peptonized. Buttermilk, koumyss, and matzoon are useful. Occasionally patients cannot digest milk; substitute thoroughly cooked gruels, made from any of the cereals, mix well with milk or animal broths, or plain water. Animal broths are of more value as stimulants than as nourishment. They must not be used alone as foods, nor if there be diarrhœa. In patients who are not seriously ill, in whom the usual nervous phenomena are absent, possessing good appetite and good digestion, ordinary mixed diet of liquids and solids is often well borne. Others, profoundly ill, exhibiting the typhoid state, badly poisoned, suffering from nausea, vomiting, poor digestion, constipation, or diarrhœa, require scrupulous care in selection of diet, and for these milk constitutes the ideal food. There are all grades between these extremes, and diet must be chosen accord-

ingly; there can be no fixed rule. Drug treatment will not lessen mortality. Symptomatic treatment of emergencies is advised. A good cathartic at the commencement of treatment is useful. The choice of the cathartic is immaterial. The so-called Brand bath is highly praised. The urine has double the toxicity of normal urine, and under hydrotherapy this is increased five times; the symptoms diminish in direct ratio as urinary toxicity increases. Cold bathing improves blood-pressure, deepens respirations, and the urine increases in amount. The first baths should be given when the temperature reaches 102.2° F. Temperature of bath, 68° F.; duration, fifteen minutes; ample friction should be used. To be repeated every three hours, when temperature is again 102.2° F. Modifications of the Brand bath are followed by less marked improvement. Coal-tar derivatives are condemned as a whole. Antipyrine does not cause improvement through elimination of toxins, for urinary toxicity is diminished by its use. These same toxins continue to be excreted for a month after convalescence begins, when antipyrine has been used. Antipyrine and others of the same group are harmful because they do not prevent the formation of toxins; they diminish their excretion. They palliate by reducing temperature. When the bath is used the toxins are all eliminated by the beginning of convalescence. Delirium, heart weakness, and bronchitis may be treated by drugs. Hydrotherapy improves these, however, without recourse to drugs, "and one does not need, therefore, to consider the drug treatment" (?). The writer proceeds, however, to recommend opium or bismuth in diarrhœa. Constipation requires enemata and laxatives. Chloral and sodium bromide will control delirium when baths cannot be given. Hemorrhage requires morphine hypodermatically and introduction of saline solution with 0.2 per cent. of calcium chloride.—*International Medical Magazine*, 1900, No. 4, p. 247.

Variety in the Diet of Typhoid Fever.—Dr. A. H. Smith doubts the wisdom of too close an adherence to a milk diet. There is no reason why part of the required food elements should not be taken in one kind of food and part in another. In milk there is albumin, fat, and sugar. The proportions present are not equally suitable in all cases. When the tissues present an excess of fat, less fat and sugar are indicated If casein is difficult of digestion some other nitrogenous food should be substituted.

Diet and temperature: In addition to the specific infection, there are absorption of poisonous food products through the unbroken mucous membrane, and septic infection from open ulcers. Enteric fever renders normal digestion very unfavorable; opportunity for chemical change and the formation of abnormal products is excellent. Fever interferes with glandular action, favors fermentation and absorption of ptomaïnes. Fluctuations in temperature above the morning remission and afternoon exacerbation are due to absorption. Therefore, diet should be such as is least likely to undergo fermentative changes. Milk, if not perfectly digested, furnishes irritating and poisonous substances. Undigested casein may form very firm granules, producing local irritation more marked than so-called solid food, the latter tend to disintegrate on their intestinal journey. Milk-curds grow more compact, forming, finally, masses of chalk-like consistency. Milk may cause flatulence, which is especially to be avoided during ulceration. A

variety of fluid and semi-fluid food may be given, even in the early stages, with decided benefit. More food than generally given is not needed, but a greater variety. For the first ten or twenty days food should be given sparingly, lest a residue, decomposing, may increase the fever. Patients are better nourished by a variety of food in small quantities than by larger amounts of a single article. The rule is to give the minimum of food that will sustain the patient. Temperature may fall as a result of diminishing the food in the early stage, when vitality is still unimpaired, and later a like result follows a more liberal diet in a less diluted form. Temperature within one degree of normal often continues until a more nutritious, semi-solid diet is given. Following are recommended articles of diet: milk, broths, soft-boiled eggs, junket, custard, soft part of raw oysters, sago, tapioca, cornstarch, animal jellies. Any rise of temperature above the usual range should cause careful scrutiny of diet among other possible factors. Mental condition excluded, increased fever, if there be abdominal fulness, is probably due to undigested food. If distention be absent, fecal absorption is occurring. If repeated, and sweating be also present, septic absorption from ulcers is the probable cause. If milk disagrees markedly the percentage of casein can be diminished by allowing the milk to stand in a cool place for five hours. Pour off the upper half for use, and restore the original bulk by water. Specks of undigested curds in movements require this procedure. Acid eructations showing the presence of too much fat demand the use of partially skimmed milk. Coffee may be added to the milk to relieve monotony; in addition it acts as a cardiac stimulant.—*International Medical Magazine*, 1900, No. 4, p. 244.

The Treatment of Pneumonia.—Dr. Nathan Raw remarks that patients are more often damaged than helped by the promiscuous drugging which they receive in this disease. At the outset three to five grains of calomel, followed by a saline every three or four hours, with which two grains of quinine are included, is beneficial. The ice-bag, or even a mustard and flaxseed poultice, may be indicated for pain. To digitalis much has been attributed, but on the whole it has not been a success. If the heart's action becomes very rapid, with a quick and irregular soft pulse, it sometimes does good when given in large doses, say fifteen or twenty minims of the tincture every two hours until two drachms are taken, or digitalin hypodermatically, one-thirtieth to one-twentieth of a grain, has a marked temporary effect in tiding over the patient during a critical period. Ten grains of chloral with four drachms of the infusion every four hours gives the patient much relief from delirium and sleeplessness. Objection is made to antipyretics, although sponging the surface with ice-water is recommended. Ammonium carbonate acts as a stimulant and expectorant, but readily disturbs digestion, and must then be discontinued. In progressive cardiac failure brandy in from six to twelve ounces every twenty-four hours is indicated. In many instances alcohol in any form is not required. Strychnine is a most valuable cardiac tonic, and given hypodermatically in doses of one-twentieth or even one-twelfth of a grain will sometimes have a miraculous effect upon the heart. His experience with oxygen has not been, on the whole, good. The prophecy is made that the treatment of the future will be

the antitoxic treatment, used early, so as to abort the disease by destroying its toxins.—*Medical Press and Circular*, 1900, No. 3181, p. 417.

Dr. J. C. Walton relies more on Norwood's tincture of veratrum viride, two to four minims every two hours or oftener, watching its effect on the pulse, gradually bringing it down to 70 or 80 and holding it there until the disease is under control. In combination with ice it more nearly approaches a specific than any other treatment. Ice-bags constantly applied over the inflamed lung and over the heart, not only for their effect in reducing the temperature and in bringing down the pulse and respirations, but for their constringent effects on the capillaries, add much to the comfort of the patient and frequently abort the disease. If the treatment should fail to arrest the disease the subsequent stage is milder and more easily managed. If it goes into the second stage give ammonium carbonate, five grains every two hours, not only for its stimulating effect, but because it is the best absorbent which we have. By thinning and dissolving the tenacious secretion the patient is enabled to expectorate without difficulty, adding, when necessary, especially if the first sound of the heart is weak, alcohol. Strychnine is the best stimulant, and should be used freely when indicated. Digitalis is of great service when the pulse is weak and rapid. Transfusion of normal salt solution should be employed in extreme cases.— *Virginia Medical Semi-Monthly*, 1900, No. 3, p. 77.

Laryngeal Tuberculosis.—Dott. A. Fasano proposes the following by insufflation: Thiocol, 1; cocaine, 2; boric acid, 10. If the tuberculosis is primary the results are excellent.

Dott. S. Loda recommends menthol, iodoform dissolved in ether, and cocaine, with which he obtains immediate relief from dysphonia.—*Gazetta degli Ospedale e delle Cliniche*, 1900, No. 60, pp. 633, 634.

Apocynum.—Dr. T. B. McGee, mentioning the aids to digitalis in chronic cardiac disease, calls attention to this indigenous plant, stating that it is excellent in cardiac dropsy if a good preparation is employed. Large doses are apt to disagree, and small ones are preferable for diuretic action. One of its active principles—apocynin—appears to resemble digitalin in its effect upon the heart, so that the diuresis produced is evidently cardio-vascular in character, and it practically represents the diuretic principle of the drug. Apocynum causes no cumulative effects, and it will occasionally prove efficient in removing dropsical symptoms of cardiac insufficiency.—*American Therapist*, 1900, No. 10, p. 193.

An Iodized Serum.—Dott. A. Sclavo notes the great importance of iodine, especially in the various manifestations of syphilis and of tuberculosis. Beside the preparations of iodine employed by various authors, he cites those produced by the combination of iodine and several proteid substances—*e. g.*, the action of Lugol's solution on egg-albumin, milk, peptone, and gelatin. By the action of iodine on blood-serum prepared aseptically he has produced an albumin-iodine preparation which may be administered hypodermatically or endovenously. Given in this form it is eliminated more slowly than when potassium iodide only is employed. In doses of from

two to four drachms or more, given subcutaneously, it is rapidly absorbed, without local or general disturbance. To the present time this has been experimented with in tuberculosis and syphilis with good results.—*Rivista Critica di Clinica Medica*, 1900, No. 14, p. 274.

GYNECOLOGY.

UNDER THE CHARGE OF

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Condition of the Uterus after Extirpation and Transplantation of the Ovaries.—RUBENSTEIN (*St. Petersburger med. Wochenschrift*, 1899, No. 31), as the result of experiments on rabbits, arrives at the conclusion that when the ovaries are transplanted and preserve their functions the uterus shows no evidences of atrophy, but when, on the contrary, they become atrophied the uterus undergoes the same changes as after castration—*i. e.*, atrophy of the muscle and endometrium, thickening of the vessels, and general hypertrophy of the connective tissue.

This disposes of Sokolow's nerve theory, since after transplantation of the ovaries to a distant locality (in one instance to the mesentery near the spleen) there could have been no re-establishment of the nerve-anastomoses between these organs and the uterus. In order that the latter should not undergo atrophy it is only necessary that the ovaries should still remain within the body and should preserve their integrity.

In the writer's opinion the only satisfactory explanation is that based upon the theory of the internal secretion or trophic influence of the ovaries, which, although not absolutely established, is supported by so many clinical and experimental observations that it may be regarded as highly probable.

Exploration of the Abdomen as an Adjunct to Every Cœliotomy.—KELLY (*Medical News*, December 16, 1899) calls attention to the importance of making a routine examination of the entire abdomen whenever the cavity is opened, since in this way unsuspected morbid conditions may be discovered when the attention is not directed entirely to the pelvic organs. Not only secondary deposits in cases of malignant or tubercular disease of the pelvis, but mechanical obstruction of the vascular, urinary, or alimentary channels may be detected. If this examination is negative both the operator and the patient have the satisfaction of knowing that no visceral lesion is present to retard convalescence or to menace life subsequently.

In conducting such an exploration strict asepsis should be maintained, preferably the use of rubber gloves with sleeves reaching to the elbows. A regular system is observed in palpating the different organs from the pelvis to the diaphragm.

There are three classes of cases in which this exploration is indicated—

viz.: 1. Those in which there is no reason to suspect disease of the abdominal viscera, and the examination is made simply as a routine procedure, which does not add to the gravity of the operation. 2. Those in which, contrary to expectation, no evidence of disease is found in the immediate vicinity of the pelvis. 3. Cases in which the nature of the pelvic lesions renders it probable that some of the neighboring or remote organs will be affected.

Abdominal Hysterectomy in Cancer of the Uterus.—MAUCLAIRE (*La Presse Médicale*, 1899, No. 76) discusses the question as to whether the abdominal method of extirpating the cancerous uterus insures a radical cure. He assumes that it should not be attempted except in the early stage of cancer of the cervix, or in cases of slowly-growing cancer of the corpus uteri. The French statistics of mortality are still high, being at the best 22 per cent.—three times as large as by the vaginal method. Moreover, many operations are incomplete, since the pelvic lymph-nodes are not removed.

It has been affirmed that there is less probability of recurrence after abdominal extirpation, and this would doubtless be true if the operation was performed at a sufficiently early stage, which is seldom the case. Sufficient evidence has not yet been obtained to justify positive conclusions.

Primordial Ova and Follicles in Senile Ovaries.—AMANN (*Ibid.*) describes the histological appearances in ovaries removed from a woman, aged sixty-three years. They contained cavities lined with cylindrical epithelium, many of the cells having large nuclei; these cavities were surrounded by spindle-cells which stained deeply. Smaller cell processes were seen near the periphery of the ovary with cystic dilatation. The cells corresponded perfectly to those of the primordial ova in the fœtal ovary, while the spindle-cells were identical morphologically with the epithelium of the primitive follicles.

The epithelial cysts and pouches doubtless originate from the germinal epithelium, as all the transitional forms are seen in serial sections. Cells like those of the primordial ova have been described in papillary and carcinomatous ovarian cystomata, but the writer believes that the case reported is the first in which the early development of adenocystoma from the germinal epithelium has been actually demonstrated, since primary follicles as well as primordial ova were present. It seems to prove beyond question that ovarian cysts develop from the germinal and not from the follicular epithelium.

It is surprising that the germinal epithelium in a senile ovary should preserve its activity and show the proliferative changes peculiar to fœtal life.

Treatment of Inoperable Carcinoma.—HERFF (*Ibid.*) regards chloride of zinc as the best escharotic, although it must be used with care. Tincture of iodine is applied after removal of the slough. Tampons covered with iodoform or nosophen should be applied several times daily. As a hæmostatic the writer prefers tampons saturated with a 5 per cent. solution of gelatin to chloride of iron. Calcium carbide is the best application to check

both bleeding and a foul discharge. The surface is disinfected thoroughly, dried, and a piece of the carbide is placed in contact with it and left *in situ* for two or three days. Healthy granulations are thrown out, the hemorrhage is checked, and in many cases the pain is sensibly diminished.

Conservative Treatment of Pelvic Peritonitis.—STRATZ (*Ibid.*) is strongly in favor of the non-surgical treatment of pelvic inflammation by means of hot douches and icthyol. He prefers conservative vaginal section to laparotomy, having performed the latter only twenty times in over 1000 cases with one death. His objection to the removal of diseased adnexa is based upon the unsatisfactory ultimate results which follow even the most thorough operations.

OBSTETRICS.

UNDER THE CHARGE OF

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Complete Rupture of the Uterus and Extirpation; Recovery.—In the *Centralblatt für Gynäkologie*, 1900, No. 19, WALLA reports the case of a multipara in labor with transverse position of the fœtus. The physician summoned to the case performed version and readily extracted the child and placenta. The vagina was tamponed with iodoform gauze. When the patient was admitted to the hospital and examined a complete laceration of the uterus was found, extending across the anterior wall down to the connective tissue behind the bladder. The patient was in good general condition, having a pulse of 108 and a temperature of 99.5° F.

Operation was decided upon for the following reasons: The patient was in good condition, although the laceration was extensive. The slight rise of temperature which was present gave an indication that septic infection very possibly had begun. The patient had been delivered in a tenement-house and had been examined by a midwife. It was scarcely possible that under these circumstances she was in a perfectly aseptic condition.

The uterus was extirpated by abdominal section and extensive laceration of this organ found, extending into the parametrium of the right side. The patient reacted fairly well from the operation. During sixteen days afterward she suffered from fever, and an infected blood-clot was removed through the vagina from the right side of the pelvis. Formation of pus followed, which gradually ceased under the use of cleansing douches. The patient ultimately made a good recovery.

In the same clinic at Buda Pesth previous experience with these cases had been as follows: There had been in the clinic 28 cases of rupture of the

uterus, of which 17 had been incomplete and 11 complete. Of the 17 all were treated without operation, but by the use of gauze drainage introduced through the vagina. Seven of these patients recovered; 10 died. In the 11 cases of complete rupture 6 were treated without operation, and all of them died. Of the 5 remaining 3 died and 2 recovered after operation. The causes of death in the cases operated upon were sepsis in one case, acute anæmia following hemorrhage in another, and in the third hemorrhage following the slipping of a ligature upon the left spermatic artery.

The Care of New-born Children.—In the *Archiv für Kinderheilkunde*, 1900, Band xviii., Heft 5 and 6, BEREND draws attention to certain points in the management of new-born children, and quotes extensively from several authors. He draws especial attention to the great necessity for the strictest cleanliness in all hospitals where new-born children are kept. As regards the care of the umbilicus, he believes that the stump of cord should be thoroughly compressed to squeeze out blood and fluid before the cord is permanently tied. The child should be bathed and put to rest as soon as possible after this, to avoid being chilled. After the bath the stump of cord should be cleaned with sublimate solution and alcohol, and should be enveloped in cotton or gauze, turned toward the left side of the child, and kept in position by a binder. The cotton or gauze which surrounds the cord should not be removed until the stump separates. The external bandage may be replaced as often as necessary. When this is done the umbilical ring should be washed with sublimate solution. The primary dressing of the cord should be disturbed only when fever occurs. The child should not be given a full bath until the cord has separated and the umbilicus is well healed.

Berend believes that washing out of the mouth of the new-born child should seldom be done through danger of contamination. He believes that much mischief occurs through improper treatment of the nipples. These should not be washed in strong antiseptic solutions, but should be cleansed only in the gentlest and least irritating manner.

The Diagnosis of Congenital Disease of the Heart.—GRIFFITH, in the *Philadelphia Medical Journal*, September 30, 1899, gives the following points as diagnostic of congenital heart disease: The history of cyanosis from birth is especially important. Next is the presence of a loud, harsh murmur, heard most distinctly in regions where the ordinary murmurs of heart disease are not heard. Third, the absence of enlargement of the heart.

Appendicitis Complicating Pregnancy.—In the *Annales de Gynecologie et d'Obstetrique*, 1900, p. 357, PINARD describes several cases to which he had been called in consultation where pregnant women had been seized with pain which was mistaken for the beginning of labor. When the cases were carefully scrutinized, constipation, fever, pain in the right side, and a history of indigestion were present. The cases were appendicitis, and the patients rapidly became seriously ill. In one case occlusion of the intestine was present, and upon operation appendicitis and subsequent peritonitis were found to be the cause of the occlusion of the bowel. These patients in

most instances aborted after the operation. Bacteriological examination showed the bacillus coli communis to be the germ most frequently present. All patients under his observation recovered after being treated promptly by operation.

Delivery by Basilysis.—In spite of the increasing success with Cæsarean section, perforation of the living child is still practised in some cases. In the *Scottish Medical and Surgical Journal*, 1900, p. 403, SIMPSON describes the case of a girl, aged eighteen years, a dwarf, admitted to the Edinburgh Maternity Hospital in the ninth month of pregnancy. The child was living and in good condition. The pelvis was universally and unequally contracted and too small to permit the birth of a viable child. The patient came into labor, and craniotomy was determined upon because the mother was "a pallid, delicate creature, who appeared a bad subject for the graver forms of interference." Simpson's basilyst was introduced, an opening made in the vault which allowed the complete breaking up of the brain and cerebellum, which were washed out with a lysol douche. The instrument was screwed into the anterior part of the head and the blades separated in different directions. The head then descended and was readily delivered without lacerating the mother. An uninterrupted recovery followed.

Simpson's basilyst combines a central perforating stem and blades, which can be used as a cephalotribe and also as tractors. That it is an efficient instrument is evident.

[The choice of operation in this case cannot be admitted without comment. Had this patient been infected by efforts at delivery before she came into the hospital, or had she been exhausted in labor, as she was a frail person, the choice of the method of delivery would have seemed to us a clearer one. But, in our experience, it is possible to deliver frail young women who have not been infected and exhausted, by Cæsarean section, with the recovery of the mother, who nurses her living child. We are aware that it is easy to criticise a case which we have not personally seen. It is, however, fair to compare experiences.—ED.]

A Problem in Antenatal Pathology. — Under this title BALLANTYNE writes in the *American Journal of Obstetrics*, 1900, p. 577, of healthy parents who had two normal children born by normal labor. Then came an abortion at the second or third month; following this ensued five pregnancies, after one of which a normal female infant was born and survived. The other four pregnancies terminated in the birth of female infants, stillborn or perishing soon after birth with hydrocephaly, anencephaly, spina bifida, general debility, malformed hands, malformed feet, and absence of the radius. In these cases there were prolonged gestation, abnormally shortened gestation, amniotic bands, and abnormalities of the placenta.

In the mother's history there was found a tendency, hereditary on her part, to malformation of the thumb, and this peculiarity was reproduced in her later pregnancies. No other cause could be assigned for these abnormalities. As regards treatment, it is suggested that the uterus be curetted and that thyroid extract be administered during the early stages of the next pregnancy.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

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Sudden Changes of Refraction in Diabetes.—G. SOURDILLE (Nantes) reports the case of a man, aged fifty-three, who had not used glasses until fifty-one, who was passing 187 grammes of sugar in the twenty-four hours. He came complaining of the sudden impairment of sight, which in four days had fallen from normal to one-sixth. Convex lenses of 2 D. restored full vision, and 3 D. added to these enabled him to read the finest print. The ophthalmoscopic appearances were normal, but the tension of the eyeball was slightly diminished. Eighteen days later, the sugar having disappeared from the urine, the patient complained he could no longer see with his glasses. He had full vision without them, and could read the finest print with + 2 D. His hyperopia had entirely disappeared, and the tension of the eyeball was normal.—*La Clinique Ophthalmologique*, May 25, 1900.

[Similar cases have been reported by Horner, Risley, and Doyne. The most probable explanation for them, offered by Horner, and which Sourdille is disposed to accept, is that the removal of water from the vitreous humor by the sugar-laden fluids of the body causes an actual shrinkage of the eyeball and consequent axial hyperopia.—ED.]

Operations for Entropion and Trachiasis.—H. HERBERT (Bombay) reports upon a large experience with these operations in India.

Generally speaking, of late, division of the tarsus from the conjunctival surface has been practised where tarsal deformity was slight or absent, and removal of a horizontal wedge of tissue from the anterior surface was reserved for the more definitely deformed tarsi.

In division of the tarsus the lid-margin was bent forward over a small roll of plaster by sutures firmly embedded in the tarsal margin below and in the skin above; or a more decided bending forward was effected over a pad of wet lint by sutures passing from lid-margin to eyebrow.

In the removal of a horizontal wedge of tarsus and overlying muscle through a skin incision and the application of specially devised sutures, the position of the wedge is important. It should be as near the free margin as possible, *i. e.*, immediately above the roots of the eyelashes. Thus there is a narrow strip of tarsus left below and a comparatively broad plate above, so that, when the anterior surfaces of the two are drawn together, any displacement which may occur will be in the more readily moved and more readily

moulded to the narrow marginal strip. The depth of the wedge should be in all cases sufficient completely to divide the tarsus. The breadth of the wedge at its base depends largely on the degree of entropion existing. Not only muscle, but a narrow strip of skin should be cut away in most cases, otherwise it is redundant afterward.

Three simple sutures properly inserted are much more effective than Snellen's sutures. The curved needle is to be introduced a little behind the most posterior lashes, and passed obliquely forward and upward, to be brought out immediately above the lower margin of the skin-wound. Thus the more the trachiasis or distichiasis the further back will the point of entry be, and when the sutures are pulled upon the more will the border of the lid be brought forward. The needle should then be passed into the anterior surface of the upper piece of tarsus well above the cut edge, and brought out again after taking a firm hold; neither skin nor muscle is taken up.—*Ophthalmic Review*, July, 1900.

Treatment of Simple Chronic Glaucoma.—M. Rooman (Gand) reports five cases operated on by iridectomy, and subsequently observed for periods varying from six to twelve years. In two of these one eye was submitted to iridectomy, and the continued use of a myotic was tried in the other. In all cases the experience was favorable to iridectomy. In one of the cases in which one eye was operated on, its vision was retained without further impairment after six years; while the eye submitted to a myotic, although it had been the better of the two, became entirely blind in two years. In the other case the operated eye retained its vision; while the vision of the other slowly deteriorated, until ten years later iridectomy was done on it, and apparently arrested the course of the disease.—*Annales d'Oculistique*, June, 1900.

Glaucoma from Homatropine.—H. Gifford (Omaha) reports a case in which an acute outbreak of glaucoma followed the use of homatropine for the measurement of refraction, in a young lady aged twenty-one. Pain set in a few hours after the use of the drug, so severe that she vomited on getting up, and vision was greatly impaired. When seen at the end of two days the tension was + 1, the media were hazy, and vision was reduced to seeing movements of the hand. When examined with the ophthalmoscope, three days later, retinal hemorrhages were found in both eyes. Vision subsequently improved to 20/70 in one eye and 20/20 in the other. Iridectomy was not done, and glaucomatous attacks continued to occur when not held in check by pilocarpin.

Since this experience, Gifford puts one or two drops of a 1 per cent. eserine solution into every eye, which he has tested under atropine or homatropine, before the patient leaves the office, with instructions to return the next day if the near vision is not entirely normal.—*Ophthalmic Record*, July, 1900.

[This case strongly emphasizes the fact that the danger of provoking an attack of glaucoma by dilating the pupil is not confined to persons who have passed forty or forty-five years of age, and it also emphasizes the importance of carefully investigating as to the presence of glaucoma before using a mydriatic in any case. Gifford does not report the ophthalmoscopic appearances

or the previous symptoms in this case. But in most such cases reason for suspicion of glaucoma might have been found before the use of the mydriatic. There have now been placed on record quite a number of cases in which homatropine was the drug that provoked the outbreak of glaucoma. It should be universally understood that, in this connection, it is less dangerous than the other mydriatics only in so far as the dilatation of the pupil it causes may be overcome more quickly.—ED.]

Poisoning by Homatropine and Cocaine.—S. STEPHENSON (London) reports the case of a girl, aged three, who received nine applications of a solution containing 2 per cent. each of homatropine and cocaine to the eyes in ninety minutes. Three hours later she failed to recognize familiar faces, picked at the coverlet, tried to grasp invisible objects, babbled strangely, and persisted in getting out of bed. Her pupils were widely dilated, her face flushed, her lips and tongue parched. There was no eruption. She recovered entirely within twenty-four hours.—*Ophthalmic Review*, July, 1900.

[The symptoms mentioned are those of homatropine poisoning, which are closely allied, but probably not identical with those of poisoning by atropine. —ED.]

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Plague and Rats.—The connection of rats with the spread of plague has long been suspected where the disease is endemic, and, in 1897, YERSIN advanced the proposition that before the disease prevails anywhere among human beings the rats of the locality are first affected. In the infected areas of India it is said that much evidence of direct transmission from mice to man has been collected. An exceptionally good case is related by BELL (*The Lancet*, May 26, 1900), though it is not conclusive, since the possibility of outside infection must be admitted. The victim was an adult Chinaman bitten in the thumb by a rat. The wound was treated by domestic methods, but at the expiration of three days the man sickened and died of plague, the diagnosis of which was confirmed by bacteriological examination.

It has been alleged that the rat acts only indirectly as the carrier of infection and that the immediate agent is the flea which infests him. GALLI-VALERIO, however, asserts (*Centralblatt für Bakteriologie, etc.*, January 6, 1900) that though the fleas which infest rats and mice may contain the plague bacillus in their tissues it has not been proved that they may transmit the

disease to man, and that the most common of the several species will not bite man at all. Certain it is at least that they would not bite him, for he confined specimens on various parts of his body under small watch glasses kept in place for twenty-four to forty-eight hours, and received not a single bite, although the kind that infests man bites him very freely. Possibly, however, some peculiarity of the skin secretions may be the explanation of their refusal to bite. Thus LOIR (*Revue Scientifique*, March 31, 1900, p. 395), being struck with the immunity enjoyed by oil carriers in past epidemics, conceived that this was due to the oil with which their persons and clothing are drenched. He made a number of experiments to ascertain if fleas would invade the fur of a rat soaked in oil, and found that they would not. He took a rat which was swarming with fleas, killed it, and placed its body in a cage in which were confined two other rats, one with normal skin and the other well oiled. When the dead body became cold all the fleas left it and went to the rat with the dry skin, not one attaching itself to the other. Loir concluded that the fleas' aversion for oil might be the explanation of the immunity noticed.

While authorities are not unanimous on the question of the importance of rats in the dissemination of plague, the subject is receiving most serious attention, and in many places a war of extermination has been inaugurated. In Hamburg, for example, an order was issued in the autumn to the police and harbor police to pay five pfennigs for each dead rat delivered before February 10 of the present year. At Aden the reward is a cent apiece for all killed within the limits of the town. At Paris the public authorities have been much stirred up for some years by the rat nuisance, and now, in view of the possibility of invasion by the disease, are especially desirous of preventing new importations and killing off those already on the ground. When the diggers for the Exposition began work some of the neighboring streets, according to *Gesundheit*, No. 4, 1900, were so extensively invaded by rats that the residents dared not leave a child in a yard or garden unattended. The markets swarmed with them, and at night the thickest meat chests were gnawed through. Cats were found of no use against them, since they are so accustomed to being fed and cared for that mice afford them merely a simple means of amusement, and rats are avoided. Where large numbers of them have been placed in the markets it has been observed that at night they affiliate with the rats in a friendly way, and make common cause against the provisions. Poison proved more effective, but only for a time, since rats become wary. Traps are useful, but not adapted to extermination on a large scale, and, moreover, rats soon learn wisdom by experience, and avoid them. Some varieties of dogs are most energetic rat hunters, among them the bull terrier, fox terrier and rat terrier. At the police headquarters four of the latter were used with great effect and were active both day and night.

The problem of exterminating rats by means of bacterial agencies has been studied by J. DANYSZ (*Revue d'Hygiene* and *Annales de l'Institut Pasteur*, April, 1900) with some success. He employed a cocco-bacillus which resembles the bacillus of LOEFFLER (B. typhi murium), which is pathogenic for mice. Danysz isolated his organism from an epidemic among field mice, and found from the beginning that it was slightly pathogenic for gray rats, that is, out of ten specimens fed with a culture of it two or three would die, others

would sicken and recover, and the rest would show no effects whatever. The positive results led to the hope of increasing the virulence by the usual methods of successive inoculations, but the process proved futile, for the virulence was thereby lessened rather than increased. He succeeded, however, by following another method, in attaining the desired results, and obtained cultures which applied to bread were successful in destroying large numbers of the animals in the sewers and shops and on farms. As a special test, on February 2d, 200 gray rats were released in a sewer 160 metres long and 3 metres wide, closed so as to prevent their escape. They were supplied with an abundance of food and straw, and at the expiration of ten days were observed to be alive and well. Then twenty tubes of culture were distributed on pieces of bread, and in eight days they began to die. During the next ten days eighty dead specimens were found, half of which were removed, and the rest left to be eaten by the survivors. On the tenth day but eight were found to be alive, and these through carelessness were allowed to escape. The experiment showed that the animals will eat the soaked bread in preference to other food, as wheat, carrots, etc., and die, and be eaten by the survivors, but that since the virulence becomes attenuated after the third or fourth passage, the culture must be freshly distributed at intervals of ten or twelve days. Young rats proved to be more susceptible than old ones.

A very cheap and effective means of destroying rats and other vermin aboard ships has been suggested by DE FERRARI, the Quarantine Officer of Genoa (*Public Health Reports*, May 11, 1900). It consists in burning charcoal in the hold after all outlets have been carefully sealed. The charcoal, of which 6 kilos are employed for each 100 cubic metres of space, is ignited with the aid of kerosene. The hold is kept closed for eight hours, during which time the poisonous carbon monoxide diffuses and is inhaled by the rats with fatal results.

DR. RUFFER, head of the quarantine office in Egypt, asserts that the danger of spread by rats is much over-estimated, and that up to the beginning of the year no ships had arrived at Suez with any evidence of dead rats aboard, and that in ships infected with the disease there had been no unusual mortality among these animals.

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